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ABSTRACT

The many forms of interdisciplinarity in higher education institutions and the various ways it has been used to advance curricular changes are examined. Definitions of interdisciplinarity and its variants (multi-, pluri-, and transdisciplinarity) provide a conceptual framework for the examination. In this study, interdisciplinarity is understood to mean interaction among two or more different disciplines and should include the idea of integration of concepts, methodology, procedures, epistemology, terminology, and data. Educational outcome models are examined to clarify the organizational premises interdisciplinary programs have adopted to achieve the goal of "integration." The development of education outcomes is addressed using the historian William Bouwsma's educational models of the aristocratic, scribe, civic, existential, Christian-secular, and romantic-naturalist ideals as ways to comprehend interdisciplinary curricular directions. Many of these ideals have become incorporated into interdisciplinary programs with little attention paid to their potentially conflicting outcomes or to Boisot's delineation of interdisciplinary study into philosophical, ethical, and educational types. The practical implications of these models are addressed through the examination of specific interdisciplinary programs. Interdisciplinary programs have the potential for generating both internal (curricular) and external (societal) change. Recommendations address certain problem areas that need to be considered before interdisciplinary programs can be effective. (SW)

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Interdisciplinarity: The Mutable Paradigm

William V. Mayville

AAHE-ERIC/Higher Education
Research Report No. 9
1978

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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Foreword

There are three major reasons why multi- and interdisciplinary approaches to teaching are gaining greater attention. First, there is an increased awareness that many contemporary social problems call for background and skill that can be developed only through training in more than one academic discipline. Second, student enrollment has decreased in some of the disciplines due to poor career prospects or general lack of interest. Many departments, in order to survive and make themselves more attractive, have moved away from a purely disciplinary orientation. Examples are foreign language departments that have developed joint programs with departments having some international emphasis, such as business or law, and English departments, which have begun to work closely with schools of journalism. Third, when institutions find that it is necessary to close down a department because of declining enrollments, they try to find alternative posts for their displaced faculty. Often faculty are offered a position with another department, thus bringing a multidisciplinary dimension to that department.

Success at multi- or interdisciplinary efforts have varied. Reasons for this have been well articulated in the OECD publication *Interdisciplinarity: Problems of Teaching and Research in Universities* (1972, p. 28). Among these are inadequately defined goals; difficulty in setting up coherent, planned programs; resistance of the traditional structures at every level—among disciplines, examinations, diplomas, jobs for graduates; and major operational difficulties (scheduling and budgeting), among others.

William V. Mayville, a research associate with the ERIC Clearinghouse on Higher Education at the George Washington University, has written a Research Report that attempts to bring some order to discussions of interdisciplinarity. He does this by developing outcome models for interdisciplinarity based on program objectives, and then reviews existing programs in light of these models. His analysis will be of great help to those who wish to understand more about interdisciplinarity and who want to avoid some of the common pitfalls in setting up such programs.

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Overview

This research report examines the many forms of interdisciplinarity in higher education institutions and the various ways it has been used to advance curricular changes. A literature search reveals a profusion of interdisciplinary programs, many of which bear only a surface resemblance to one another. To understand these differences, interdisciplinary programs were chosen for review that typify the differentiation. The process whereby these programs were developed is examined, along with information about faculty and students who participate in such programs.

To provide a conceptual framework, definitions of interdisciplinarity and its variants (multi-, cross-, pluri-, and transdisciplinarity) are given. An examination follows of what are thought to be major obstacles to using an interdisciplinary format in colleges and universities: the dichotomy of science and humanities that makes it difficult for faculty to decide on course content and objectives; the specialized nature and territoriality of the graduate divisions of social science, science, and humanities that impede developing continuity across disciplinary lines throughout a student's undergraduate career; and the confusion over what constitutes general education as it relates to interdisciplinary program building.

Often the goals of interdisciplinarity and the goals of general education are the same—especially when words like "enrich," "broaden," and "integration" are used to define the goals. While the "core" curriculum is thought to be the means to these goals, the structure and content of the means vary considerably, as do the educational outcomes. There is no attempt to define the core curriculum or the purposes of general education. But it is suggested that possibilities exist for clarifying general education outcomes using an interdisciplinary format. Consequently, a section is devoted to a discussion of educational outcome models that would be useful to think about when building interdisciplinary programs. Among the models considered are the aristocratic ideal, which contains a whole person-leadership training emphasis; the scribe ideal, which venerates the bibliophile; and the civic ideal, which combines elements of the aristocrat and scribe ideals under the aegis of the nation state and its social goals.

In this study, interdisciplinarity is understood to mean interaction

among two or more different disciplines and should include the idea of integration of concepts, methodology, procedures, epistemology, terminology, and data. The interdisciplinary programs discussed here are categorized as revolutionary, professional, and educational: revolutionary means the program represents a transition from the traditional to the unique and could have profound consequences by pointing toward a totally different way of viewing the curriculum or the purposes of education; professional means that upper-division undergraduates, usually seniors who are about to enter graduate school, are given an opportunity to integrate their specialty with other specialties and to see how they relate to larger questions, such as public responsibility; programmatic means the interdisciplinary activity is thought of as broadening and usually is offered to lower-division undergraduates.

It is concluded that interdisciplinary programs have the potential for promoting change within the institution and society, but certain problem areas need to be addressed before such programs can be effective. It is recommended that interdisciplinary program outcomes be clearly specified and evaluation mechanisms be developed based on program characteristics. There must be institutional belief in and support for interdisciplinary endeavors; the disciplinary reward system will have to be altered to accommodate and sanction interdisciplinary activities on a par with disciplinary efforts both in teaching and research; the relation of the sciences to nonscience areas should be considered when designing interdisciplinary programs; the training of interdisciplinary faculty and staff to serve as role models for students is crucial to the perpetuation of these programs; interdisciplinary programs should be carefully articulated at all educational levels—from lower division to upper division to graduate—to provide students with a framework for viewing the world beyond that afforded by their individual specialty.

Introduction

The worldwide rush of events in the late 1960's, including a war, a student revolution, and dramatic changes in social mores, served as a catalyst from which emerged new and promising relationships between schools and society. By the mid-1970s, however, many of these innovations had become victims of economic strigencies, attenuating enrollments, and public accountability pressures. Interdisciplinary programs, an experimental revival from the 1920's and 1930's, seem less likely to suffer the same fate, although they bear an academic stigma of being "nondisciplinary." In an era of specialization, there can be no worse indictment.

In 1972, a short time after the implementation of many curricular innovations, Ohmer Milton reported that there was only a feeble movement away from disciplinary study toward an interdisciplinary mode of education. He regretted that few students of the then eight million in higher education were profiting from the interdisciplinary experience, especially at large state and regional institutions (Milton 1972, p. 105).

The same year, the National Board of Graduate Education maintained that not enough was known about the contemporary use or potential of interdisciplinary graduate programs. In their view, too little was known about the curriculum, field and research experience, faculty training, and program organization to arrive at anything close to an endorsement (Graduate Board of Education . . . November 1972, p. 16). Questions still are raised about the consequences of any approach labelled "nontraditional." Blackburn and his colleagues commented that much energy goes into producing alternative programs and teaching processes but wonder if these efforts made a difference when compared to traditional educational delivery systems (Blackburn et al. 1976, p. 43).

In contrast, European educators believed that the interdisciplinary approach to higher learning was one form of nontraditional study that had merit. As early as 1970, an international seminar, under the auspices of the Centre for Educational Research and Innovation (CERI), was held in Nice, France, to consider the nature of interdisciplinarity and its impact on teaching and research (OECD 1972). During the comprehensive and comparatively erudite discussions, many papers were read that greatly contributed to clarifying interdisci-

plinarity, including Jean Piaget's "The Epistemology of Interdisciplinary Relationships" and Erich Jantsch's "Toward Interdisciplinarity in Education and Innovation."

A 1977 directory of interdisciplinary courses and programs in the United States included over 800 colleges and universities in its listings (Bayerl 1977); clearly, more students have the opportunity to elect an interdisciplinary major, and greater numbers of educators now believe academic interdisciplinary experiences are of more than passing interest. In South Carolina students majoring in interdisciplinary areas nearly doubled between 1976 and 1977 (260 to 413) (South Carolina . . . 1977, p. 46). The usefulness of interdisciplinary approaches to solving social problems has influenced institutional willingness to undertake organizational change to accommodate university-community research programs. According to George Potter (1978, p. 16), president of Ramapo College of New Jersey, an institution organized around interdisciplinary themes,

> . . . even the most hidebound of institutions will nowadays acknowledge the synergistic potential of interdisciplinary research and will allow the formation of research programs and study institutes outside of the established departmental lines.

Federal Support

To bring about growth of interdisciplinarity, the National Endowment for the Humanities (NEH) has funded curricular experiments and provided professional guidance to help institutions develop interdisciplinary models appropriate to their context. NEH requested $121.5 million for fiscal year 1978, of which nearly $600,000 will go to colleges and universities for advice on how to build effective humanities programs, and $3.5 million will go "to help colleges develop experimental courses and programs, curriculum materials . . . [and] study of the humanities in the professions. . ." (NEH "Summary. . . 1978," pp. 3, 7-8).

The National Science Foundation also supports the development of new interdisciplinary programs through its LOCI (Local Course Improvement) program. In fiscal year 1977, $495,100 of LOCI's $2.2 million budget went toward funding interdisciplinary programs; this represents 31 out of 124 grants. However, in fiscal year 1978, of $2.5 million, only $197,600 went for such programs, representing 12 grants out of 135.* Most of these grants involved combinations of one or

* The National Science Foundation also sponsors CAUSE (Comprehensive Assistance to Undergraduate Science Education). The majority of grants fund

more sciences, but not science-humanities combinations (McGuire 1978 and Straumanis 1978). NSF staff were surprised by this drop in interdisciplinary proposals; guidelines had suggested that proposal writers label such requests either disciplinary or interdisciplinary, depending on how they wanted their grant request to be reviewed. NSF also had augumented its staff of interdisciplinary evaluators in anticipation of a larger number of applicants under this category. This year, encouragement of simultaneous joint submission of proposals to the NEH pilot program and the NSF LOCI program may promote more proposals in fiscal year 1979 that seek to relate the sciences and humanities (Straumanis 1978).

Social Potential and Institutional Response

Interdisciplinary programs are frequently tied to local or regional themes or reflect institutional consensus that may or may not include more generally applicable outcomes. The pluralism that characterizes American education institutions, as well as the multiplicity of value systems that pervades our culture, often particularize and fragment consensus on academic and social issues. There is a tacit assumption that institutionally defined outcomes are good for society and the student.

Undoubtedly the need for specialists as reflected in manpower need-analysis studies and emloyment opportunity bulletins influences many students' choice of academic concentration. Potter (1977, p. 8) wonders what an employer's response will be to the average graduate of an interdisciplinary program at a state college or university compared with the graduate of a pilot program at a prestigious university when they both enter the job market. The Pennsylvania Department of Education reported that in 1976, 527 interdisciplinary baccalaureate degrees were awarded, with only 18 percent of the recipients employed in the "field" in which they took their degree; however, of those who received an interdisciplinary master's degree (29), 69 percent were employed in their field. This high percentage is second only to theology (75 percent), and higher than education (68.9 percent). (Donny 1977, pp. 3, 7).

Despite this marketplace encouragement, the faculty reward system and peer pressures discourage many professors from taking inter-

interdisciplinary work. In fiscal year 1978, 73 awards were made, totalling $12.9 million. Of these, 24 percent went to two-year institutions, 47 percent went to four-year institutions who award the baccalaureate or master's degree, 26 percent went to Ph.D.-granting institutions, and the remaining 3 percent to consortiums (Oliver 1978).

disciplinary study or even general education too seriously, "instruction in such courses being considered a distraction from specialization, research, and writing" (Carnegie Foundation . . . 1977, p. 183). This attitude is especially true of scientists, perhaps due to a belief that their knowledge constructs have no analogy to the humanities (the reverse can be argued as well) or that the time required to master the rudiments of their disciplines means that their subject matter should not be watered down for general consumption. It could be argued that since the basic goal of interdisciplinary programs is (1) integration of knowledge fields and (2) the production of students who can draw relationships among seemingly disparate bodies of knowledge, it would seem reasonable that a student, regardless of major, could benefit from exposure to interdisciplinary learning experiences.

Brian Hill writes in *The Australian University* journal that the present-day disciplines came about "not primarily to promote discovery and development of theory (which favour divergent rather than convergent thinking), but to serve as convenient teaching packages for transmission to the next generation of students." In Hill's opinion, the problem for interdisciplinary program-builders is that disciplinary endeavors "are notoriously resistant to major overhaul, as are professional programmes, [since] both tend to stress information-receival in contrast to the questioning spirit which led to the original leaps forward" (Hill 1976, p. 51). He persuasively comments on the need for students and faculty to be able to grasp an issue that is larger than field or departmental territoriality:

> Attempts to clarify the differentia of each discipline are numerous in university quarterlies and educational studies. They founder . . . because neither the content nor the intellectual methods used are unique to any one discipline. One can hold the content constant and ring the changes on the methods used to investigate it; or one can hold the method constant and apply it to all kinds of content. For example, one can take the theme of Perception and study it physiologically, philosophically, and aesthetically. One can take mathematical logic and apply it to philosophy, chemistry, and operations research, to name but a few.

Interdisciplinarity does pose a threat to the idea that knowledge can be divided into discrete paradigms that only infrequently overlap; it also raises the issue of whether disciplines can reasonably insist on the absoluteness of their methodology or the uniqueness of the problems they address. There is no doubt that interdisciplinarity has proven to be a useful tool in confronting issues of national and international significance, which usually require the opinions of individuals from a myriad of disciplines. It is this reality that makes

it urgent to consider how to build interdisciplinary experiences for students that they can refer to later when they assume responsibility for solving problems beyond their discipline as it is now defined.

In the next chapter interdisciplinarity is defined, followed by a discussion of educational outcome models and their institutional embodiment in a number of existing interdisciplinary programs.

What is Interdisciplinarity?

Some Definitions

Definitions of interdisciplinarity vary slightly but significantly. For example, Carter Good, in his *Dictionary of Education* (1973), defines the "interdisciplinary approach" as:

> a method of study by which experts, or the best research workers from many different fields of learning, are brought together in the examination of a particular problem that is relevant to all their approaches; for example, a child-development problem may be studied by a team composed of a psychologist, doctor, social psychologist, educator, psychiatrist and sociologist (Good 1973, p. 311).

In Good's definition, individuals are not expected to change or to develop a more integrative approach to their own discipline; instead, they retain their separate intellectual identities and knowledge contexts. Some would use this meaning to describe a multidisciplinary instead of interdisciplinary approach to higher learning, although interdisciplinary potential exists in Good's definition.

The Southern Regional Education Board (SREB) defines interdisciplinarity as the interaction of disciplines. This denotes:

> cooperation among various disciplines in the same science or academic area, leading to interaction and to a certain reciprocity of exchanges, resulting in mutual enrichment, such as the liberated life sequence at Davis and Elkins and the English-speech course at the University of Texas at Austin (SREB 1976, n.p.n.).

In Edward Blishen's *Encyclopedia of Education* (1970), "interdisciplinary inquiry" (as contrasted to Good's "interdisciplinary approach") is illustrated by a curricular experiment at Goldsmith College of the University of London. Generally, it is said that education:

> . . . should be based on *inquiry*, interpreted broadly to include exploration (of materials and ideas), self-discovery, and growth in perception of other people, and the creation and testing of hypotheses in both theoretical and practical studies. [Therefore], since most fundamental questions reach beyond subject barriers, an inquiry based education must necessarily be largely *interdisciplinary*. [Because knowledge has become increasingly more complex], education should stress acquiring skills and interpretive concepts of the discipline rather than subject matter, and this involves for part of the curriculum a co-operative interdisciplinary study, with specialist teachers acting as advisers and consultants (Blishen (ed.) 1970, p. 387).

Here, interdisciplinary inquiry is not viewed as an effort to lessen the importance of disciplines "as coherent intellectual or aesthetic systems. . ." (p. 387; also see Halliburton in Quehl 1977, p. 48; and Potter 1977, p. 15). The anticipated result is to make learning a collaboration between teacher and pupil, so that students work individually or in small groups instead of listening to lectures. This view has been applied in schools in England since 1965.

Perhaps the most frequently used definitions of interdisciplinarity and related concepts are those developed by the Centre for Educational Research and Innovation (CERI), Paris, France. They appear in a report of the Seminar on Interdisciplinarity in Universities, organized in collaboration with the French Ministry of Education and held at the University of Nice, September 7 through 12, 1970. The report is called *Interdisciplinarity: Problems of Teaching and Research in Universities,* and was published by the Organization for Economic Cooperation and Development in 1972. To facilitate discussion, a questionnaire entitled "Survey of Interdisciplinary Activities of Teaching and Research in Universities" was mailed to participants before the meeting, and it was headed by the following definitions:

- Discipline—A specific body of teachable knowledge with its own background of education, training, procedures, methods and content areas.
- Multidisciplinary—Juxtaposition of various disciplines, sometimes with no apparent connection between them, e.g.: music+mathematics+history.
- Pluridisciplinary—Juxtaposition of disciplines assumed to be more or less related. e.g.: mathematics+physics, or French+Latin+Greek: "classical humanities" in France.
- Interdisciplinarity—An adjective describing the interaction among two or more different disciplines. This interaction may range from simple communication of ideas to the mutual integration of organising concepts, methodology, procedures, epistemology, terminology, data, and organisation of research and education in a fairly large field. An interdisciplinary group consists of persons trained in different fields of knowledge (disciplines) with different concepts, methods, and data and terms organised into a common effort on a common problem with continuous intercommunication among the participants from the different disciplines.
- Transdisciplinary—Establishing a common system of axioms for a set of disciplines e.g. anthropology considered as "the science of man and his accomplishments" (OECD 1972, pp. 25-26).

These definitions frequently have provided the nucleus for subsequent definitions of these terms, as is suggested by a reading of the Southern Regional Education Board's (SREB) 1976 newsletter on interdisciplinarity and L. Richard Meeth's "Interdisciplinary Studies: A Matter of Definition" (*Change,* August 1978).

For purposes of comparison, the *Southern Regional Education Board* defines multidisciplinarity as occurring when the solution to a problem makes it necessary to obtain information from two or more sectors of knowledge, but without the disciplines drawn on being changed or enriched. SREB provides the examples of environmental or ecological institutes, and health science or service centers, all of which draw energy from various realms of expertise that is applied toward the solution of a problem *without* altering the normal academic process of the particular disciplines engaged. The definition of pluridisciplinarity is essentially the same as that used by CERI, with the additional comment that disciplines presumed to be related are matched to enhance the relation but with no deliberate coordination of subjects. Finally, transdisciplinarity "establishes a common system of axioms for a group of disciplines not commonly related—a multilevel coordination of a large and varied set of academic sciences (usually involving the entire educational system), such as the four centers for public policy research at Vanderbilt University" (SREB 1976, n.p.n.).

In essential agreement with CERI and SREB's definitions, L. Richard Meeth includes the notion of *cross-disciplinarity*, as "viewing or observing one discipline from the perspective of another: describing the physics of music or the politics of literature. . ." (Meeth 1978, p. 10). Meeth views interdisciplinary studies as a term that can include cross-, multi-, and transdisciplinarity within its constellation, which is visualized as a pyramid: intradisciplinarity is its base, above which in ascending order are cross-, multi-, inter-, and transdisciplinarity. The rationale for his construct seems to be based on the practical consideration that most of the programs cited in *Change* magazine's sample included various combinations of his pyramidal layers: "Because few programs fit neatly into any one of the classifications, most presented here combine the elements of all" (p. 10).

This practical accommodation can be contrasted to Piaget's theoretical discourse on "The Epistemology of Interdisciplinary Relationships"; multidisciplinary "occurs when the solution to a problem makes it necessary to obtain information from two or more sciences or sectors of knowledge without the disciplines drawn on thereby being changed or enriched"; interdisciplinary is "where cooperation among various disciplines or heterogeneous sectors in the same science lead to actual interactions, to a certain reciprocity of exchanges resulting in mutual enrichment"; and transdisciplinary, "which . . . not only cover[s] interactions or reciprocities between specialized re-

search projects, but would place these relationships within a total system without any firm boundaries between disciplines" OECD 1972, pp. 136-139). Piaget considered each form to be hierarchically separate and distinct.

Another European educator, Erich Jantsch, further refines these concepts by suggesting that, in relation to inter- and transdisciplinarity, multi- and pluridisciplinarity denote only "the purposeless and purposeful grouping of rigid disciplinary modules." He then distinguishes inter- and transdisciplinarity as the only legitimate format to precipitate change:

> . . . cross-disciplinarity implies a "brute force" approach to reinterpret disciplinary concepts and goals (axiomatics) in the light of one specific (disciplinary) goal and to impose rigid polarization across disciplines at the same level. Only with inter- and transdisciplinarity does the education/innovation system become "alive" in the sense that disciplinary contents, structure and interface change continuously through co-ordination geared to the pursuit of a common system purpose. Inter- and transdisciplinarity thus become the key notion for a systems approach to education and innovation (Jantsch 1972, p. 107).

Piaget, in contrast to Jantsch, maintains that the final stage of interdisciplinary endeavors is transdisciplinarity.

It may be that the best interdisciplinary experiences tend toward transdisciplinarity and that a course could be structured to elicit this outcome. At present, at least in the programs surveyed here, the elements of Meeth's multiconceptual pyramid do commingle under the quasi-generic term *interdisciplinary*. Nevertheless, the defintions provided in 1970 by the Centre for Educational Research and Innovation, because of their categorical nature, are used as the touchstone for the subsequent discussion and analysis in this monograph.

Contexts for Interdisciplinary Study

Asa Knowles, in his recently published *International Encyclopedia of Higher Education*, places the recrudescence of interdisciplinary activities in the late 1960s and early 1970s, when

> . . . existing patterns of higher education were being criticized by university teachers and students alike, when demands for radical changes in teaching methods and curriculum were numerous . . . [and when] interest in the concept of interdisciplinarity related to research as much as to teaching (Knowles ed. 1977, p. 2208).

Some fields, like American Studies, have always required at least a multidisciplinary approach at both the undergraduate and graduate

level. This holds true for International Education, which suggests, for example, a course mix of political science, sociology, cultural anthropology, comparative economics, and comparative educational systems. Other subject areas that might use interdisciplinary approaches include Women's Studies, Black Studies, and International Relations. Developing fields like Future Studies, Ecology, and Ekistics, by definition, require some type of crossing of disciplinary lines. Unfortunately, many of these fields have used only cross- or multidisciplinary approaches instead of trying to provide an integrative, interdisciplinary program. There are exceptions. At Ramapo College of New Jersey, they found:

> that the boundary lines set between some disciplines were obscuring effective analysis of critical emerging social questions found in fields such as International Relations and Environmental Planning. [They] decided to create new interdisciplinary units that would apply the methods and analytic tools of various disciplines in new examination of these problem areas (Potter 1977, p. 5).

Frederick Rudloph (1971, p. 249-250) cites some reasons why the interdisciplinary model of American Studies was not adopted as a framework for emerging fields of study:

> Interdepartmental majors based on an interdisciplinary approach led troubled careers. The oldest and most successful of these, American Studies, in many places where it was longest established, was dependent for staffing on the not always reliable generosity of traditional departments. Interdepartmental majors and programs, although they ameliorated excessive concentration and supported breadth as a curricular purpose, struck at the specialization and departmentalization that were the repositories of bureaucratic power. American Studies, an inspiration of the cultural self-consciousness of the 1930s, was a good enough idea for both students and teachers that its organizing principles, especially the concept of culture, might have become a way of organizing majors and programs in French studies, English studies, Spanish studies, Russian studies, and so forth. But that is not the way it happened. The area programs of the 1960s in Russian, African, Chinese, and Latin-American studies owed little or nothing to the curricular experience with American Studies. They were a product of foundation enthusiasm, government grants, and a certain nervousness about the future of American foreign policy and success in war and commerce. Because they were almost wholly synthetic and required almost everywhere the bringing together of a cluster of specialists who had not yet mastered the principle or the appropriateness of some integrating concept, these programs collapsed when financial support withered.

Many professors in traditional subject fields have generally resisted the interdisciplinary approach as inappropriate at the graduate level; instead, they have concentrated on interdisciplinary offerings at the

undergraduate level, usually in the form of "core" courses or programs that do not violate the preprofessional nature of their disciplines.

At the heart of the issue is the conflict between teaching and research, especially in an interdisciplinary context. Research is primarily associated with graduate or upper-division undergraduate training, and teaching primarily with collegiate undergraduate training, especially lower-division undergraduate education. If this distinction holds, then faculty might well be expected to resist interdisciplinary activity at the graduate level, and even at the undergraduate level for students who they believe need to specialize as soon as possible. It will be recalled that both Alexander Mieklejohn (1971) in the 1930s and Joseph Tussman (1969) in the mid 1960s thought the first two years of college were the time when "intelligence," not "scholarship" should be weaned. Thus, they concentrated on teaching in an interdisciplinary (Meiklejohn at Wisconsin) or a subdisciplinary (Tussman at Berkeley) milieu. The American Association of State Colleges and Universities challenges the assumption that general education (one of the uses to which interdisciplinary programs are put) should be relegated to the first two years of college and specialized learning to the third and fourth years. The association points out that

> studies have shown . . . many students are more self-motivated to take work outside their specialties after they have gone deeply into one or two areas and can better see the interrelationship of ideas, and when they are more intellectually and personally mature (AASCU 1974, n.p.n.).

Faculty Cultures

Eighteen years ago, William Cowley of Stanford suggested that the wearing away of the present system of curricular organization would take decades and expressed concern about the conflict between the sciences and humanities. At that time, he proposed hiring as many "broad-gauged" new faculty as possible; but he observed that this goal would not be possible until the graduate school of arts and sciences was considerably altered (Cowley 1960, p. 14).

Jerry Gaff and Robert Wilson wrote in 1970 that plans to alter higher education that employ interdisciplinary strategies will probably not succeed unless faculty cultures are taken into account. They define these cultures as: humanities, social science, natural science, and professional or applied. The authors believe that "most interdisciplinary efforts must be staffed by cultural 'outcasts,' faculty who have resisted narrow cultural conditioning or have been exposed to more than one culture" (p. 199).

The reason for the development of faculty cultures has to do with (1) socialization into a pattern of behavior common to one's peers: "social science and humanities professors purportedly learn to be socially critical, tolerant, and people-oriented as part of their undergraduate and graduate training;" and (2) a "theory of attraction," whereby "persons with particular patterns of interests and values are attracted to an intellectual culture which is consonant with their predispositions" (p. 198).

The result of this acculturation can be applied to disciplinary paradigms. For example, Gaff and Wilson perceive that "those who teach in science and professional subjects adopt a body of knowledge approach," which means that "only a physicist knows what a physics curriculum should include" (p. 190). Furthermore, "the more codified the knowledge of a field, the more likely that professors will adopt a tightly focused and structured teaching style, and the less codified a field, the more professors will tend to adopt a wide-ranging, discursive teaching style" (p. 192).

> The disciplines which are most codified or systematized use either a scientific or analytic strategy; these are primarily mathematics and the natural sciences. The less codified fields, generally in the humanities, and to a lesser extent in the social sciences, tend to use either direct or inspirational strategies (p. 192).

A 1978 study by Mark Thompson and David Brewster, which analyzed behavior at a large land-grant university in the mid-South, supports Gaff and Wilson's findings. Using Lodahl and Gordon's framework of low-paradigm (sociology and political science) and high-paradigm (physics and chemistry) disciplines, Thompson and Brewster report that more high-paradigm faculty believe only faculty should establish degree requirements and that students should not have an opportunity to select areas of study than do low-paradigm faculty (Thompson and Brewster 1978, p. 174).*

There obviously is still far to go to find "broad-gauged" faculty, especially in high-paradigm disciplines. This lack of such educators may account, at least in part, for the desire of curricular reform proponents to put disciplinary prerogatives into a different focus by employing problem-centered or epistemologically-oriented strategies to build curricula that respond to national or international needs. In this context, as the 1976 annual meeting of the American Associa-

* See Barry Morstain and Joan Stark's article on the persistence of faculty cultures; "Educational Orientations of Faculty in Liberal Arts Colleges," in the *Journal of Higher Education* 49 (September/October 1978): 420-437.

tion of State Colleges and Universities, the membership adopted the statement that "consideration should be given to the establishment of university-wide interdisciplinary courses which emphasize . . . universal ideas" (AASCU 1976, n.p.n.).

General Education, the Core Curriculum, and Interdisciplinary Study

Dissatisfaction with the general preparation of undergraduates has been growing, as have complaints about the basic knowledge students gain in preparing for the world of work. Earl McGrath (1978) believes it is a hopeful sign that prestigious faculties like Harvard and Berkeley are questioning the purposes and character of higher education (p. 8). Recently, Harvard University undertook a two-year review of its undergraduate curriculum, and found that as presently constituted it did not clearly express its basic "educational drive." Under the direction of Dean Rosovsky, the new "core" curriculum is designed to ensure that Harvard students "acquire basic literacy in the major forms of intellectual discourse."* While interdisciplinary courses are ideally suited for such purposes, the single mention of such a course in Harvard's proposed revision is under "Literature and the Arts." This course is intended to show the connection between the arts, literature, and their social and historical setting. However, no link was formed to nonhumanistic areas.

A chemistry professor at Harvard, commenting on the core curriculum, said that the two proposed science and mathematics courses provide insufficient background to arts and social science students, and that, in general, the curriculum was a public statement by the faculty that "science occupies a minor, perhaps only trivial place in the intellectual heritage of mankind" (*London Times Higher Education Supplement*, March 24, 1978, p. 4). Why this should be so may be due to an implicit humanistic bias that assumes that knowledge breadth and values result more from the study of history, philosophy, literature, and the like than from the study of physics, mathematics, chemistry, biology, or astronomy (see Table 1 in the "Program" section for a listing of institutions that use "humanities" as an integrative concept). The rationale for employing the humanities as the integrative principle is clearly stated by AASCU:

> Through the disciplines of the liberal arts, people achieve a clearer understanding of their place in the natural world and their relationships with fellow human beings. Through the awareness of their various cultures,

* The University of Santa Clara's core curriculum is built around Dean Rosovsky's views on the goals of the educated person. See "Programs" chapter.

> they gain a tolerance for divergent viewpoints, achieve a sensitivity toward differing expressions of beauty and come to possess a desire to achieve qualitative excellence in their lives (AASCU 1977, n.p.n.).

Often, the values and utility of science are thought of as narrowing and provincial: the notion of intellectual curiosity, which should characterize science training, the notion of objectivity, and the practical consequences of science are frequently not viewed as "values" except in a pejorative sense—e.g., science as destroyer and dehumanizer. Consequently, there is serious debate in colleges and universities about how best to accommodate and employ the insights of science, not only in introductory interdisciplinary courses but throughout a student's education.

Three institutions that seek to address this issue are the University of Southern California, through its "Thematic Option" program, which includes a course on the Process of Change in Science, Worcester Polytechnic Institute, where the goal is to produce "technological humanists," and the University of Santa Clara's "da Vinci Program," which is offered by the College of Engineering (all three are described in the "Program" section). The expressed concern that science has been short-changed in the development of the proposed core curriculum at Harvard suggests that, with few exceptions, the fissure between science and other disciplines has yet to be filled and that the fundamental relationship of science to other disciplines is not being addressed adequately by scientists and nonscientists alike.

New Outcomes, New Structures?

In 1960, Cowley wondered whether the time was approaching "when the relatively new tripartite categorization of science, the social sciences, and the humanities . . . [would] give way to a problem-centered classification" (Cowley 1960, p. 13). Daniel Alpert (1969) recommended that the department be thought of as the degree-granting academic unit of the university and that the responsibility for building a problem-oriented team should reside within an interdisciplinary center. However, this approach would create as many problems as it would solve: How are faculty assignments determined? What students participate and when? What role do the humanities play on such teams? What status would the Center have in a disciplinary-oriented bureaucracy?

The problem-oriented approach is one of the common varieties of interdisciplinary study and has even been accomplished on an institution-wide basis. The University of Wisconsin at Green Bay is or-

ganized along these lines. Chartered by the state legislature in 1965, it received a mandate to focus on environmental problems, including consideration of scientific, societal, cultural, and aesthetic questions. The Green Bay program is frequently cited as one of the boldest interdisciplinary approaches in the nation and has received international attention as a possible institutional prototype (Sheppard 1978, pp. 30-33).

Despite such interdisciplinary successes, disciplinary prerogatives usually supersede integrative approaches to learning and serve as a constant reminder that much must be done to create a climate of opinion within which to rejuvenate curricular structures.

To deal with social and technical complexities of a changing world, and the necessity for cultural enrichment in the wake of excessive specialization, interdisciplinary formats must develop epistemological sets or organizing principles capable of cementing disparate disciplines. The next chapter examines educational outcome models as a way to clarify the organizational premises interdisciplinary programs have adopted to achieve the goal of "integration." That discussion, in turn, is the basis for a description and analysis of a number of interdisciplinary programs.

Educational Models and Interdisciplinarity

One of the perennial problems for curriculum designers is how to achieve educational outcomes that mirror the great diversity that characterizes American society. Senator Charles Mathias of Maryland was prompted to assert that "the most serious challenge before [educators] is to restore a consensus in our society on what the goals of higher education should be" (*Chronicle of Higher Education*, November 22, 1976, p. 3). He went on to say:

> . . . in the past, two imperatives have shaped our American system of higher education—the need for an *educated citizenry* capable of informed decisions necessary to the success of representative government, and the need for *national growth through innovation*. While faculty members wish to stress research and academic disciplines, students and their families have been looking to colleges to train them for jobs. . . . To dispell this . . . confusion, I suggest a return to tradition. . . I would state our goals for higher education in traditional terms. . . Higher education's purpose is to produce truly educated men and women [emphasis added] (*Chronicle*. . ., Nov. 22, 1976, p. 3).

What constitutes truly educated men and women is the crux of the matter, since outcome models of the educated person have varied considerably over the years. Blackburn and his colleagues (1976, p. 40) believe there is an outcome confusion on the part of the faculty:

> . . . by loosening the requirements in general education, the faculty are not only seeming to say that general education is not as important as it once was, but also that they are no longer as sure what an "educated" person is.
>
> Not so very long ago, leaders in education said that one must first of all be an educated person, then a lawyer, doctor, or economist. That is, the concern for the education of the whole person, and particularly for her or his liberal education, came first. Today, there is less consensus on what constitutes a liberal education, and, as if by default, the choices have been left to the student.

In William Bouwsma's opinion, the knowledge revolution that created the age of the specialist spawned the decline of the idea of general education, so that "in the popular mind, an educated man is now some kind of specialist; . . . in a sense we no longer have a single conception of the educated man, but as many conceptions as there are learned specialists" (Bouwsma 1975, p. 207).

A basic condition of the present-day college curriculum is implicit in the need of students to receive a "liberal" undergraduate and graduate education and at the same time to pursue a career through specialized study. Attempts to resolve this dilemma give rise to the need for a clearer statement of what society wishes to be the educational outcome(s) of higher education. In Senator Mathias's view, politically enlightened citizenship and innovative intellects should be the twin goals toward which educational institutions should struggle. Obviously, the issue devolves to who formulates the model(s) and for what purposes. Since interdisciplinary studies theoretically prompt integrative outcomes, some typologies will be examined to provide a basis for developing a coherent and useful outcome model that might accommodate current educational and social needs in an interdisciplinary format.

Bouwsma, of the University of California at Berkeley, developed some general notions of the educated person that will be used as the first point of reference. His models included the aristocratic, scribe, civic, Christian-secular, existential, and romantic-naturalist ideals. All bear on interdisciplinary courses and programs and their presuppositions, especially when words like "integration," "culture," "community," "value," and "individual development" are used.

A second point of reference comes from Marcel Boisot (OECD 1972), of the Ecole Nationale des Pons ed Chausees de Paris, France, who refines the operative fields of interdisciplinary study into three types: philosophical, where the focus is on epistemology and the history of science; ethical, where sociopolitical concerns are paramount, as is the pursuit of a concrete human goal; and educational, where training students to grasp the unity of reality is the object, whereby knowledge is transferred in an integrated manner. Boisot points out that:

> Since the distinction among these three operative fields has not generally been recognized, along with the fact that no general agreement has been reached on the scientific and human objectives of scientific research, the heuristic aspects and the application mechanisms of interdisciplinarity are constantly being confused (Boisot 1972, p. 97).

This confusion stems in large measure from an inability to clarify the relationship between general and particular program outcomes where points of divergence and convergence are identified. The dovetailing of an ethically directed or social-problem-oriented interdisciplinary course that, in Boisot's terms, includes an epistemological and educational integration outcome is the equivalent of the notorious committee-built camel with three humps. This disarray may account for what

some observers perceive as the diffuse quality of many interdisciplinary endeavors and reflects faculty confusion over how and why interdisciplinary programs and courses should be constructed.

The following discussion attempts to draw out the major ideational strands that characterize interdisciplinarity, as well as examine briefly the origin of the theoretical-practical dichotomy that Boisot identifies as a fundamental cause of confusion over educational outcomes, which curriculum specialists can experience when developing interdisciplinary programs.

Aristocrat and Scribe

The aristocratic ideal finds embodiment in the role of warrior, knight, baron, and gentleman, and its educational outcome is that of conspicuous achievement, prestige, or leadership. The outcome is highly elitist, its essence being the quality 'to rise and to remain above the other men" (Bouwsma 1975, p. 196). The training to prepare a person for such a role is multidimensional and integrative (the aim of interdisciplinary programs), and necessitates physical, moral, and social development—the "whole person" concept that infuses many general-education, as well as interdisciplinary, programs is paramount. But the aristocratic ideal does not include an emphasis on substantive knowledge nor does it value the disciplined mind, even though the development of a world view can be presupposed.

As if to confirm this theory, in the mid-nineteenth century, Matthew Arnold referred to the English aristocracy as a kind of outward shadow of the ideal of culture, which suffered from a "sleep of mind," caused by "a torpor of intellectual life, a dearth of ideas, and indifference to fine culture or disbelief in its necessity" (Arnold in Buckler 1958, p. 143). Arnold hoped that his all-encompassing notion of culture—capsulized as the best that has been thought and known in the world—would whet the appetite of the middle-classes for a life of the mind (consonant with the scribe ideal), and that they, in turn, would provide the model for the "working" classes that the aristocrats could not supply.

Arnold's notion of liberal culture was embraced in America by Charles Eliot, president of Harvard in the latter half of the nineteenth century. The attraction for Eliot was the special sense in which Arnold's idea summed up aspiration toward "breadth, taste, heritage, and idealism" (Hawkins 1972, p. 264), and seemed compatible with the collegiate aims of "character" and "gentlemanliness." However, proponents of liberal culture in America at that time overly stressed "standards" and felt threatened by numbers:

> *Few of their formulations attended to democratic values,* and in many ways they resembled the orthodox German university professors who sought to revise philosophical idealism as a protection against industrialism, with its mass culture, interest in politics, and technological emphasis (emphasis added) (Hawkins 1972, p. 264).

The middle classes in America, for Arnold the standard-bearers of the future liberal culture, did seek the presumed benefits of education in large numbers. But this, in itself, did not bring about the social utopia it seemed to promise:

> the state of mind of the [late nineteenth century American] college student reflected his predominantly middle-class origin, his parents' ambition, and his own rather self-conscious desire to indulge in youthful good fun. The undergraduate temperament was marked by a strong resistance to abstract thinking, and to the classroom in general, by traits of practicality, romanticism, and high-spiritedness and by passive acceptance of moral, political, and religious values taken from the nonacademic society at large (Veysey 1974, p. 222).

At the "better" universities in America, it was often "poor form" to obtain more than a "C" in a course, which represented the "gentleman's grade" (Veysey 1974, p. 272). The middle class sought to emulate the upper-class nonchalance about the academic side of their education, even though the assumption of social, economic, or political power did not obtain at the conclusion of their training. It remained for another educational ideal to awaken the middle-class student's seriousness of purpose and to provide an economic basis for social advancement.

In contrast to the aristocratic model is what Bouwsma characterizes as the scribe ideal. Literacy, not birth or wealth, connotes social superiority, and it is a superiority based on books. In scribe culture education is equated with the acquisition of a body of knowledge (a high-paradigm faculty predisposition) and the formally educated man is considered a learned man (Bouwsma 1975, p. 198).

The contrast between the aristocratic and scribe cultures became especially apparent in the early twentieth century as the social order shifted toward a middle-class culture and a much less transcendental value structure. In contrast to the aristocratic ideal, the scribe ideal did not seek to create heroes or to concern itself with the "whole-man" concept; as Bouswma puts it, "while the aristocrat displayed himself to the world, the scribe gave it wary service" (p. 198). The scribe moral ideal includes "such useful but equivocal virtues as prudence, calculation, and foresight, economic enterprise and thrift, vigilence and reticence" (p. 198).

Its chief outcomes were presumed to be honesty, virtue, loyalty, temperance, charity, cheerfulness, and personal stability. But its intellectual component, which presumed an advance from proficiency in the use of language to the higher arts of verbal and rational discourse, was "in sharp contrast to aristocratic concern with the shaping of the total personality" (p. 199). The cultural expansiveness of the aristocrat was replaced by the narrowly defined intellectual tendencies of the scribe specialist. In its ultimate form, all dimensions of personality are subsumed by intellectuality.

Specialization and Liberal Culture: Bouwsma believes the origin of the liberal arts was crystalized in the scribe ideal of developing man's "higher" mental faculties. This may seem ironic, given the tendency toward narrowness that imbues the scribe culture: the scribe ethos is acquired by precept rather than by practice, and from books rather than from direct experience (p. 199). This picture is an apt image of the medieval university, and even today gives rise to criticism of higher education as nonessential unless it yields a practical outcome, often defined in terms of social utility. Because the medieval university seems to represent the scribe so fully, it will be briefly described and contrasted with the other institutional embodiment of the scribe ideal, the German research university.

The outcome of the early medieval universities, when compared to the educational outcomes needed by modern societies or to the aristocratic ideal, looks somewhat constricted. The curriculum included only the trivium (grammar, rhetoric, and logic) and the quadrivium (arithmetic, geometry, and music). The curriculum had a particular bias: the twelfth century renaissance, which had stimulated an interest in classical learning, was "crushed in its early youth by the triumph of logic and the more practical studies of law and rhetoric" (Haskins 1957, p. 29). As a consequence, Aristotelian logic reigned as the pedogogical foundation for legal, medical, philosophical, and theological study. The curriculum was book-bound, nonexperiential, and nonexperimental; however, once the question of theological authority was resolved, the professors and students could dispute all issues, including scientific matters.

The medieval university was based on a comparatively simple academic premise, and at first glance might seem to have had an integrated curriculum; however, it clearly was no more or less particularized than the curriculum of today. Even so, Charles Fethe (1973, p. 490) speaks of the "Grand Coherence of the medieval summa," implying a world view that eventually gave way to the

"trend toward specialized diversification among the branches of knowledge." There is no doubt that the oreintation of modern universities toward specialization makes it very difficult for them to establish a curricular framework or form a common core of "necessary" subjects. Disciplines and fields of study vie with each other when confronting societal and academic issues. And the desire for satisfactory premises—which are not well developed—on which to base educational outcomes is one of the chief obstacles for those who wish to arrive at consensus about educational policy.

The German research university, a second scribe ideal incarnation and the prototype for the American graduate school, helped to define educational outcomes in terms of the production of research scholars and new knowledge. There is, in its outcome, a recognizeable but incomplete image of the scribe ideal. While the idea of liberal culture did not find a place in its structure, the quest for scientific knowledge without necessary regard to its consequences for the individuals, institutions, or society did remain. Sir Eric Ashby outlines what the German research university excluded from its programs:

> . . . the German university threw its energies into research and the training of research workers. The ideal put before the student was not the liberal humanism which had permeated the new University of Berlin under the leadership of Wilhelm von Humboldt; it was a single-minded, almost fanatical devotion to the advancement of knowledge. It was an enthusiasm which excluded philosophy (for, they said, had not the impotent speculations of the nature-philosophers deprived Germany of years of precious time for experiments?) ; it excluded the applications of science, too (for technology was not admitted into the university pattern: even before the end of the eighteenth century it had been relegated to separate Technicle Hochschulen); and it excluded any idea of education-for-life (Ashby 1958, p. 25).

By the early twentieth century, there was growing dissatisfaction with the exclusively intellectual orientation of the German university, accompanied by a hint of the return to an aristocratic, whole-person emphasis:

> . . . In combination with the amoral or central emphasis on the scientific outlook, the almost exclusive intellectual orientation of the university ideal exposed young men and women to the dangerous underdevelopment of the whole person (Rudolph 1972, p. 450).

This turn of events seemed to promise a revival of a broader concept of educational outcomes and raised the question of the purposes of higher education for the student and for society.

However, there was a force acting against this tendency. The evolution of the curriculum into subject fields during the nineteenth century and the concomitant search for individual epistemologies that would legitimate a given field in the academic or intellectual canon resulted in a "hierarchy of disciplines . . . based on an increasing complexity and decreasing generality" (Knowles, ed. 1977, p. 2209). The familiar Aristotelian principle of going from the particular to the general subsumed the Platonic notion of reasoning from any general concept and proceeding to interpret the particular.* It should be said that for the empiricist Aristotle, as well as the idealist Plato, philosophy was still the most important "science" and was the quintessential study to be undertaken by the student. In this regard Fethe (1973, p. 492) argues that the discipline inherent in the ongoing philosophical tradition could "provide the experience needed to bridge the gap between different modes of thought" and recommends philosophy as the nucleus for all contemporary interdisciplinary endeavors.

Recent discussion of the core curriculum and the uses of interdisciplinary study may be understood as an effort to restore the generalizing power to the student beyond the restrictions of his or her own disciplinary epistemology. It might also be explained as an effort to equip a student with the rudimentary tools to develop a personal world-view based on a considered reconstruction of his or her own experience and the experience of others. By extension, this would suggest that responsible citizenship is best carried out by those whose vision is much broader than the metaphysics of their personal choices or academic specialization.

But those who would look to the humanities as the generalizing, integrative, or comprehensive principle for interdisciplinary curriculum building as an answer to scribe culture and a restorer of liberal culture do so with little regard to history. The Renaissance understanding of the *studia humanitatis* meant a clearly defined cycle of scholarly disciplines: grammar, rhetoric, history, poetry, and moral philosophy, including the reading and interpretation of ancient writers in Latin and, to a lesser degree, in Greek (Kristellar 1961, p. 10).

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*Demetrius of Phalerum (345?-283) student of Aristotle and one of the organizers of the library at Alexandria, first introduced divisions and subdivisions of knowledge to permit specialization in given fields of study (Speziali in Wiener, ed., 1973, p. 463).

> . . . Renaissance humanism was not as such a philosophical tendency or system, but rather a cultural and educational program which emphasized and developed *an important but limited area of studies.* This area had for its center a group of subjects that was concerned essentially neither with the classics nor with philosophy, but might be roughly described as literature (emphasis added). (Kristellar 1961, p. 10).

Furthermore, it required only one philosophical discipline—morals —and excluded logic, natural philosophy, metaphysics, as well as mathematics and astronomy, medicine, law, and theology (p. 9). In no sense can the humanities be thought of as a comprehensive field of study capable of shaping a curriculum apart from interaction and integration with other areas of knowledge. The "humanities" was certainly not the notion Arnold had in mind when he defined culture. This is a useful caveat when speculating about the outcome differences of distribution requirements versus interdisciplinary study. If interdisciplinary courses and programs do not foster an outcome beyond a humanities orientation, then the distribution requirements may be a more comprehensive, though less potentially integrative, option (see Martin et al., 1971, p. 23).

The Civic Ideal

A third model of the educated man, which combines elements of the aristocratic and scribe model, is the *civic* ideal. By this concept, the object is to blend the idea of education as activity and education as contemplation in the ideal of citizenship—man as political animal (Bouwsma 1975, p. 200). The individual's talents and proclivities become subordinate to the collective needs of the state and the state becomes the touchstone for educational decisionmaking.

Since collective ideals are transmitted by literary culture, broadly defined, a standard body of written classics, including scientific literature, is used to provide a common culture, which is viewed as the link uniting all men; hence Eliot's "five-foot shelf" of classics, Meiklejohn's (1932) notion of books forming the basis of "intelligence," and Erskine and Hutchins' "Great Books" plan at Columbia and Chicago, which formed the basis of St. John's of Annapolis curriculum. The aim is the "informed citizen" as backbone of a free society. This notion also is found in Arnold's idea of liberal culture ultimately leveling class distinctions (Buckler, ed. 1958, pp. 475-476. See Arnold's *Culture and Anarchy:* "Sweetness and Light").

The civic ideal forms the basis of many interdisciplinary programs. Education becomes fully identified with general culture and not with the domain of any particular professional group. As a byproduct of

this concept, the educated person is also virtuous and will make decisions in relation to the general welfare of society.

The roots of the civic ideal are in the European Enlightenment; for example, the French economist and physician Francois Quesnay believed that if a nation were fully educated, then tryanny would be ruled out automatically (West 1975, p. 122); the English social philosopher and economist Jeremey Bentham wrote that "The social problem [is] to design efficient institutions so the course of action most beneficial to an individual would always be beneficial to others . . ., [the ultimate aim being to create] a system of education to design model citizens" (West 1975, p. 172); and the Scotch economist Adam Smith thought that government support of education "would encourage the spread of scientific knowledge to ordinary people [who] would [in turn] become captivated by the intellectual problems that confronted them in their daily work. . . This . . . would lead to aesthetic and noble sentiments which . . . would result in a tranquil and reflective society" (West 1975, p. 123). The result of this tenor is:

> the autonomous rational man . . . whose education has freed him from the superstitions of the past, who has indeed a duty, again the morals of the civil ideal, to oppose the collectivity when it is wrong (Bouwsma 1975, p. 202).

This concept of responsible citizenship including criticism is present in contemporary discussions of the role of government support for intellectuals. The current chairman of the National Endowment for the Humanities, Joseph Duffey, remarked that in the case of artists and intellectuals, the availability of public monies should not tempt them from having "the nerve to dissent and a will to stand up against official definitions of and prescriptions for social benefit" (Duffey 1977, [p. 3]). Duffey went on to say that in America we are just beginning to appreciate "the courage and daring of the social experiment, the unique character of our enduring political institutions, and the capabilities of our people to take risks of individuality" (Duffey 1977, [p. 7]).

The civic ideal received institutional embodiment in America in the Experimental College at the University of Wisconsin. This was essentially an experiment in interdisciplinarity that lasted from 1928 to 1932 (see Levine 1978). The genesis of the Experimental College can be traced to the need for a "general" education that would acquaint students with the then-exploding frontiers of knowledge. As early as 1902, Dewey had expressed the opinion that the tremendous

expansion of course offerings was caused not by "faculty pedagogical organization: but rather [by] the rapidly expanding knowledge of the arts and sciences." To solve this problem he advocated "survey" courses to provide the student with an orientation to the larger world (in Brubacher and Rudy 1976, p. 272).

Prior to World War I, when Meiklejohn was a dean at Brown, he introduced just such an undergraduate survey course in social and economic institutions. Ten years later, he advocated two levels of survey courses—one for the lower-division students and another for seniors. After the successes in general education experiments at Columbia and Dartmouth following World War I, Meiklejohn spearheaded a program for freshmen and sophomores at Wisconsin using the idea of comparing and contrasting an ancient (Greek) and modern (American) civilization (Brubacher and Rudy 1976, p. 222).

For Meiklejohn, the primary question was "What teaching does America need from its colleges of liberal understanding?" The answer was not to be found in activities related to "trades, crafts, vocations, professions," nor was it to be discovered "in the midst of those special investigations . . . which we sum up under the term scholarship" (Meiklejohn 1933, p. xv). Rather, the outcome of liberal education is "intelligence." Liberal teaching tries to create and cultivate insight of understanding as against the unrelatedness of scattered bits of knowledge" (p. xvi).

Such a symbiotic ideal is called for today by Stephen Bailey (1977, p. 38):

> America needs minds that have the skills of relating one thing to another, of seeing connections. . . . There is a compelling need to develop syndetic courses and exercises that force students to look for connections—connections between the runoff of farm fertilizers and the death of Lake Erie; connections between the Mideast, political crisis and the price of gasoline in Peoria; connections among drought in the Middle West, Soviet economic priorities, and starvation in India; connections between gadgetry and pollution; connections between corruption and inflation; connections between prejudice and domestic crime.

This kind of experiment in interdisciplinarity requires risk-taking. For instance, among the teachers at the Experimental College in Meiklejohn's program only one had ever taught in the field of Greek learning, even though that was to constitute the whole of the curriculum for the first year. All had to become learners along with their students; also, they had to assemble "out of the bewildering confusion of literature bearing upon the the history and interpretations of American life" an integrated course of study (Meiklejohn 1933,

pp. 42-43). This experience often typifies initial efforts at interdisciplinarity even today, although the willingness to take risks outside one's specialty is practically unheard of.

Like Meiklejohn, Joseph Tussman (1969) structured the controversial and ill-fated Experimental Program at Berkeley around the idea of preparing for citizenship and modeled it on Meiklejohn's concepts. Tussman believed that "the relation of society and government to the mind of the citizen is the most crucial and neglected of problems" (p. 66). Furthermore, "the American college today [1969] betrays its function if it does not take its democratic tutelary and initiatory tasks seriously" (p. 67). In Tussman's opinion

> the doctrines of individual freedom are playing havoc with the spirit and operation of constructive institutions of growth and liberation, dooming us to a life of change through weakness and conflict rather than through strength and understanding (Tussman 1969, p. 67).

For Tussman, curricular discontinuity between the lower and upper division was accepted and delighted in: "The lower division would be better off on its own. But the university community would be poorer without it" (p. 63). The emphasis at the lower division was to be "moral rather than scientific, normative rather than descriptive" (p. 115). Lower-division students should look at questions of freedom and authority, the individual and society, conscience and law, acceptance and rebellion. This meant the Berkeley program was thematic and not historical-comparative, like Meiklejohn's Experimental College curriculum.* The students' course of study focused on ancient Greece, seventeenth-century England, the development of the American constitution, and contemporary society.

The curriculum was designed to respond to the demand for relevance and to replace the student's question, "What should I do with my life? and the preemptive answer of society, "Do this," or "Do that," or "Do as you're told," with "What are we up to?" as a nation and as citizens.

Other Models

Three further models of the educated man will be summarized that relate to the development of programmatic frameworks for interdisciplinary study. The first is an extension of the civic ideal and is based on the detachment of the educated person from society in a

* See, among others, the University of Southern California's "Thematic Option" in the "Program" section.

way that ultimately leads to feelings of not being a part of the mainstream. This detachment recommends an existentially based curriculum design, whereby students pick and choose according to their understanding of the cultivation of private excellence as opposed to preparation for participation in the larger society. Possible outcomes are "the formation of taste and refinement, [and] aesthetic and intellectual snobbery" (Bouwsma 1975, p. 202). In this model:

> Learning . . . is no longer seen as a resource with which to manage the world but as a private consolation for the sufferings inflicted by the world and as a means of escape from it . . . [where] education is no longer the development of power for use in the world, but rather one of the defensive strategies of the personality to avoid contamination by it (Bouwsma 1975, p. 202-203).

The penultimate model, the Christian-secular ideal, is one that throws into question one's ability to solve problems by reason alone, a view Cardinal Newman eloquently expressed in his *Idea of a University*. Newman held that the cultivation of virtue was separate and distinct from the cultivation of the intellect through liberal learning: "Liberal Education . . . is simply the cultivation of the intellect . . . and its object is nothing more or less than intellectual excellence" (in Buckler 1958, p. 192). Human government and conduct are not thought of as completely respectable; the most education can do is "civilize." Consequently, the student can "freely choose the kind of education best suited to his needs, as he defines them for himself in the particular and concrete circumstances of his existence" without regard to any ultimate values implicit in the experience (Bouwsma 1975, p. 205), hence an accommodation to the secular world and its demands.

From this emerges Bouwsma's last model, the romantic-naturalist ideal. The innate characteristics of the individual, rather than any social, ethical, or religious assumptions, locate the center of this concept in biology, developmental psychology, and learning theory (see Metropolitan State College in the "Program" section). "Every capacity for personal development is seen as worthy of encouragement, since each is by definition natural" (Bouwsma 1975, p. 206). In contrast to the scribe ideal and in common with the aristocratic ideal, the emphasis is not on intellectual development per se apart from other dimensions of personality; here "the perfection of the body, the life of the senses, the feelings, the imagination, and adjustment to all the circumstances of daily life" are extolled (Bouwsma 1975, p. 206). Bouwsma maintains this model "suggests a less social idea of man,

although, by its indiscriminateness and its lack of objective norms, it is also singularly democratic."

Summary

In this section, the development of education outcomes has been addressed using the historian William Bouwsma's educational models of the aristocratic, scribe, civic, existential, Christian-secular, and romantic-naturalist ideals as ways to comprehend interdisciplinary curricular directions. As a consequence of the transmutational process of history, many of these ideals in varying combinations and emphases have become incorporated into interdisciplinary programs with little attention paid to their potentially conflicting outcomes or to Boisot's delination of interdisciplinary study into philosophical, ethical, and educational types. The practical implications of these models are highlighted in the next chapter, which examines a selection of interdisciplinary programs that typify the variety and scope of offerings and occasional struggles to come to grips with outcome definitions that are merely disciplinarity in a new guise.

Interdisciplinary Programs

The interdisciplinary programs cited in this section are wide-ranging in their application and understanding of interdisciplinary theory and practice. In the broadest sense, they are typical. But, as we have seen, definitions of interdisciplinarity differ and outcome definitions of such programs are diverse or often imprecise, so the organization of programs into types is problematic.

This section will build on Boisot's notion of interdisciplinary operational fields as a practical way to organize program types. Boisot suggested the fields of philosophy (epistemology), ethics, and education could be used as categories to delineate interdisciplinary activities. By extension, his typology will be applied to interdisciplinary courses and programs. The categories used are by no means absolute reflections of Boisot's schema, but they do retain recognizeable elements of Boisot's original concepts, especially the "ethical" and "educational" categories. They are: Revolutionary (philosophical—institutional or program paradigm shift); then the Professional (ethical), and finally the Programmatic (educational).

Revolutionary here is used to mean a context within which the traditional disciplinary apparatus has been dispensed with as an operating principle, and interdisciplinarity replaces it. The institutions in this category are generally small, new, and set up to meet contemporary needs. Professional represents an institutional context where training specialists is the overriding educational goal and where an interdisciplinary format is used to acquaint students with the broader, often ethical or social consequences or dilemmas of their chosen professional field. Within the Programmatic category are interdisciplinary programs that seek to broaden the cultural and intellectual framework of the student. These institutions tend to be large (there is an exception given here) or have a professional thrust, but their interdisciplinary programs are more comprehensive and usually begin earlier than those listed as Professional. Many take place during the first two years of undergraduate study.

There is some overlap. Philosophical (epistemological), ethical, and general cultural issues may be dealt with in any of the institutional categories; even so, the primary focus of interdisciplinary activity is deemed to take place under the headings developed.

This program categorization also is somewhat analogous to the

educational outcome models or "ideals" described in the previous chapter. The Revolutionary programs incorporate romantic-naturalistic, existential, and civic ideals. The Programmatic uses of interdisciplinarity include the "aristocratic" emphasis on the development of the whole person and reflect Meiklejohn's emphasis on citizenship: they concentrate on "intelligence" rather than "scholarship" as the suitable outcome for the first two years of college. The Professional programs tacitly accept the notion of the scribe specialist but confront the issue of interdisciplinary integration by seeking to develop responsible citizen-professionals sensitive to the societal implications of their discipline. In all three program types, the possibility of science-liberal culture paradigm confrontation exists. More often than not, these ideals must be inferred from program descriptions instead of being explicit in outcome statements. In this respect, some of the programs listed are exceptional.

Table 1 sets up a matrix of program types and program characteristics so that the reader can more easily identify programs of special interest. Judgment was required when characteristics were implied or not explicitly stated. The table should be useful as a tool to analyze and evaluate interdisciplinary programs and is not to be taken as an absolute description of the program cited, but merely as an indicator.*

Revolutionary

Monterey Peninsula College (Monterey, California)—Monterey Peninsula is a junior college that has developed a time-segmented interdisciplinary curriculum called Gentrain (General Education Train). When all segments are completed, the student satisfies all general education requirements with the exception of the English composition and science courses.

Program impetus was supplied by a $30,000 grant from the National Endowment for the Humanities for the purpose of helping Monterey Peninsula "improve learning efficiency." The original scheme focused on somehow organizing "all the world's history, philosophy, and art in a finite period of time" (Nash 1978, p. 38).

The result was Gentrain, which was a comprehensive program ar-

* Possible uses of the table would be to compare a program's integrative principle with its outcome or program outcome with curricular approach: Also questions such as, To whom are programs available and at what level? and What is the relationship between curricular approach and program outcome? can be quickly grasped. Other questions like, What roles do faculty play in program design? can be traced by using the "Faculty (Involvement)" column. The reader is encouraged to peruse all programs discussed.

Characteristics / Programs	Curricular Approach				Integrative Principle				Faculty		Students						Program Outcome		
	Thematic	Historic	Traditional	Individual	Humanities	Science	Sci.-Hum.	Student	Involvement	Problems	Upper	Lower	Anyone	Selective	Grading	Aristocrat	Scribe	Civic	Romantic-Natural./Existen./Christian-Secular
Revolutionary																			
1. Monterey Peninsula	X			X				X	X			X	X		X				X
2. Evergreen State	X			X				X	X	X	X		X						X
3. Schoolcraft College				X				X	X			X	X		X			X	X
4. Metropolitan State			X					X	X			X	X					X	X
5. Worcester Polytechnic	X						X				X	X	X		X			X	
6. University of Wisconsin Green Bay	X							X			X	X	X					X	
7. Griffith University	X				X	X			X		X	X		X				X	
Professional																			
8. University of Houston Clear Lake					X	X			X		X		X					X	
9. University of Kentucky			X			X					X		X						
10. Carnegie-Mellon University	X							X			X	X		X				X	
11. University of Florida Gainesville	X				X						X		X					X	
12. American University		X						X	X		X						X		
13. Portland State University		X			X	X			X			X	X					X	
Programmatic																			
14. University of Southern California	X				X							X		X					
15. University of Santa Clara					X		X	X	X			X	X	X		X		X	
16. University of Minnesota	X								X		X	X	X	X					X

ranged into sixteen independent segments, each segment focusing on a particular historical period. One semester unit of credit is given for successful completion of each sixteen class-hour, two-week segment. Students have the option of selecting the course segment that interests them most. The fields of study are: history/political science, literature/drama, art, and philosophy. The segments begin with ancient Egyptian, Greek, and Roman civilization and proceed to present-day themes of women's liberation, jazz, and modern ethics. It was decided that to present material only chronologically was not an adequate format, so a thematic approach was adopted. A common theme is developed and interwoven throughout the historical period [from which] . . . the interdisciplinary planning (rather than multidisciplinary) aspects of the material [emerges]" (Nash 1975, p. 53).

When the curricular reconstruction began, faculty teams were formed to visit institutions where interdisciplinary programs or courses were going on. Team members were drawn from art history, drama, history, language, literature, and philosophy/religion. One issue that confronted team members was how much time to devote to supplying historical information on any given subject. Once this issue resolved itself, each team member developed materials pertinent to their specialty. For each unit, learning objectives, large-group and small-group learning strategies, evaluation techniques, and a bibliography were devised. The designated team of instructors currently meet two to three weeks before the start of their module to determine how their presentations would fit together. The four faculty who run Gentrain are from the fields of philosophy, art history, literature, and history/political science.

It is readily admitted that integration of the disciplines historically and across subject lines cannot truly be achieved, since students can board or leave the "train" any time they wish. Fifty-five percent stay the entire journey. Of course, the theme for the modules constantly changes, so theoretically one could devise or take the "train" an infinite number of times and still not exhaust the possible journeys available. In this respect, the Gentrain program is a revolutionary idea in that its curricular premise is constant self-renewal.

Gentrain attracts students who are much older than the typical college freshman or sophomores; the median age is 55. Many are senior citizens, women resuming their schooling, veterans, or handicapped persons. Many have master's and some have Ph.D. degrees. The intent of the Dean of Instructional Planning, Philip C. Nash (1978), is to find ways to encourage 18-to-20-year-olds to participate in Gen-

train so they can benefit from the range of experience represented by the current student mix.

Students can choose various forms of evaluation: university transfer-level letter grade; credit/no credit that permits transfer to another state college or university; and individual enrichment for neither grade nor credit.

It should be noted that there is no science component. Also, Gentrain themes are chosen by faculty who do not collaborate with students in this decision. Students do have the freedom to choose what segments they want to take. In this way, it resembles the romantic-naturalist mode, since individual student choice is maximized and the faculty are free to choose themes, even a theme dealing with the relation of science to the humanities. The possibility of epistemological issues being raised in such a program structure is always present.

Evergreen State College (Olympia, Washington)—Evergreen State is a relatively new (1967), nontraditional, state-supported, open-admission, four-year liberal arts college. It uses as a curricular framework three teaching-learning modes: Individual Contracts, Group Contracts, and Coordinated Studies. One-third of Evergreen's students participate in full-time interdisciplinary study.

In Coordinated Studies, four faculty and 80 students work on themes such as "The American Revolution," "Life and Health," or "Conceptions of the Self." Program length varies from one quarter to two years. As at Monterey Peninsula, the faculty determines the theme, structure, and curriculum. Teaching modes are lectures, field trips, retreats, individual conferences, and even student vacations.

Levensky (1977) comments that the Evergreen experience has shown it is not difficult to think of good themes for interdisciplinary programs. He also observes it is much easier to make an interdisciplinary program work well if the faculty and students in the program are full-time and if there is a space available where participants can meet and exchange views—lounge, seminar rooms, faculty offices, and the like.

Evergreen faculty meet once a week for a "faculty seminar" on a topic relating to their theme; also, each teacher sets out to learn something about the disciplines of his or her peers. Accordingly, when the Coordinated Studies program works well, teachers and students:

> (1) do learn important things that they all want to know about a general, interdisciplinary, intellectual theme; (2) they discover important connections between academic disciplines and gain some knowledge, often elementary knowledge, of particular disciplines; (3) they learn to work together in seminars and in larger group meetings; and (4) enjoy the one-

to-one, one-to-all fellowship of a committed group on a successful pilgrimage (Levensky 1977, pp. 42-43).

It is pointed out that occasionally faculty have unexpected difficulty teaching with other faculty in interdisciplinary programs or believe they have the prerogatives they had when teaching in a disciplinary program. Some of the problems faculty encounter are that (1) they can no longer teach what they know best but instead must learn something difficult in another discipline; (2) they can no longer teach what they think they should teach and how they think they should teach it; (3) they are no longer the final authority in the classroom; and (4) in teaching interdisciplinary courses, they expose their weaknesses to their colleagues. It is recommended that all these factors should be carefully weighed when undertaking interdisciplinary activities.

A revolutionary aspect of this program lies in its open admissions. Many interdisciplinary programs accept only the best students or postpone such programs until the final year of college. Again, there is the potential to develop a theme to address epistemological or theoretical questions or to focus on practical themes.

Schoolcraft College (Livonia, Michigan)—Schoolcraft College (1977) provides the student, not the faculty, with curricular authority. The name of its interdisciplinary program is Independent Human Studies. Students design their own projects with minimal guidance from faculty. There are no prescribed courses and all the students' academic energy is focused on their project. At the beginning of the semester, the student, aided by an IHS facilitator and student member of the group, develops an idea for their interdisciplinary endeavors. The student then determines what academic departments can offer the most guidance and will assign credit for the work. A contract is devised that lists goals, processes, resources, and schedules to be met. The work is largely independent, although the resources of academic departments and the community are drawn upon. Workshops are given that emphasize various learning skills, and group interaction among Independent Human Studies Students is anticipated. The hope is to create a "community of learners," with the IHS group functioning as a "community of scholars" in support of the student's academic pursuits (Schoolcraft College 1977, p. 2). The project is capped by a written paper, or visual or oral presentation or any other suitable format that reveals the knowledge and competence the student gained during the semester.

Instructors in the disciplines award grades, determine numbers of

hours of credit, and decide what departments will award the credit. They also annotate the student's work for transcript purposes. Up to twenty or thirty instructors, as well as members of the staff or community, act as consultants. The commitment is for one semester at a time and is indicated by signature on a contract.

Interest and success are greatest among mature adults who return to college after an absence of several years, but the age range is between seventeen to past fifty. The appeal of charting one's own course to the mature student is obvious. The potential for accommodating shifting social and intellectual dynamics and placing their potential in the hands of the student is unique. The existential and romantic-naturalist ideals are perfectly embodied here. Like Monterey Peninsula, Schoolcraft is a two-year institution; hence, the absence of specialist or scribe orientation and the emphasis on the whole-person concept. In these institutions, the civic ideal may be infered, but it is not explicitly stated.

Metropolitan State College (Denver, Colorado)—Metropolitan State is an urban, non-residential, open-admission college. Three-quarters of its student body are employed full or part-time. The college believes it is through academic programs that nonresidential students can best be reached and not through services and activities that play such an important part in the lives of residential students. Its interdisciplinary approach centers on STAR (Steps to Abstract Reasoning) begun in the fall of 1977. STAR program goals are: to enhance reasoning skills through cognitive development; to teach conceptual skills; to teach critical thinking skills; to foster exploration of ideas of self-discovery; to develop a framework for approaching and solving problems; and to explore several college subjects in one year.

STAR is based on the learning theories of Jean Piaget and is one of several such programs taking this approach.* Its evaluation design is being coordinated with the University of Nebraska-Lincoln, Illinois Central College (Peoria), and Essex County College (Newark, N.J.). The basic approach is to teach reasoning through content. Piaget's theory takes account of two levels of logical reasoning in human intellectual development, concrete and formal thought, each being characterized by certain reasoning patterns. When an individual realizes a concrete reasoning pattern cannot solve the problem, the process of self-regulation should lead the individual to accept formal reasoning based on "direct experience with the phenomena and the

* See, for example, Xavier University of Louisiana, described by *Change* magazine's August 1978 "Report on College Teaching."

introduction of related organizing principles and major concepts" (Karplus 1977, pp. 9-8, 9-9). This means an individual can potentially transfer formal reasoning patterns to a new area "especially if the new and old are closely related, as in the case with mathematics and science."

The freshman courses are introductory—earth science, mathematics, macro-economics, and comprehensive reading (all are fall courses); physics, psychology, micro-economics, philosophy, and history (all are spring courses). A writing course is also given each semester. It is expected that a chemistry and an additional mathematics offering and an introduction to problem solving will be available in fall 1978.

The design of STAR was done on an interdisciplinary basis by faculty from eight disciplines: economics, English, geology, mathematics, philosophy, physics, psychology, and reading. Faculty who teach the various courses in STAR meet periodically throughout the semester to discuss how their subjects relate to concept development and to share teaching ideas. The students' experience of STAR is, however, not interdisciplinary based, in the sense that courses are not team taught; although there is much overlap of concepts from course to course.

It will be recalled that the romantic-naturalist ideal focused on developmental psychology and learning theory. Certainly Metropolitan State's STAR program falls into this category. The articulation of program outcomes with departmental or institutional goals remains to be explored.

Worcester Polytechnic Institute (Worcester, Massachusetts)—Worcester Polytechnic is a small, private engineering college. In 1970, it was decided to radically restructure the curriculum around the idea that science education is a critical part of liberal education. The outcome is expected to be the creation of "technological humanists" (Roark 1977, p. 8).

To bring this about, Worcester first did away with all specific course requirements and put the student in charge of his or her academic career. However, there are some general requirements that must be satisfied. Students begin by achieving a sufficiency requirement in five thematically related courses, followed by an independent project or study, which counts as one-fourth of their degree program. This means actually minoring in a branch of the humanities or social science, which requires "a thorough study either within a single discipline or across several disciplines within a single time period" (Baker 1978, p. 16). Projects range from writing theses to producing

films (Roark 1977, p. 8). Then students must complete an Interactive Qualifying Project that has to do with the relation of technology to a social or human problem, which can be done individually or in a team setting. It also counts as one-fourth of the degree requirement. Finally, a Major Qualifying Project that represents another one-fourth of the degree requirement concentrates on the student's chosen field.

Worcester also offers a number of interdisciplinary courses: "Humanity and Environment," designed to introduce freshmen to an integrative approach to the sciences and humanities; and "Light and Vision," which examines the scientific psychological, and artistic responses to light, "an everyday phenomenon that has mystified people since the earliest myths of creation" (Baker 1978, p. 171).

The problem most frequently mentioned is the inadequacy of the advising system. Also, the number of faculty has not risen proportionally with the number of students. Participation in the Plan is required for students but voluntary for faculty, and a number of faculty remain devoted to their own research (Baker 1978, p. 17).

In President Hazzard's view, if another institution were to adopt Worcester's "Plan," it would have to be supremely self-confident. It also ought to be small and have a core of what Hazzard calls "middle-aged Turks"—faculty who have tenure and who want change. Hazzard believes that what is generally exportable is the "willingness to develop diversity" (Baker 1978, p. 19).

Worcester has confronted the integration of science and humanities in a way that mirrors civic ideals and is conducive to forging new disciplinary relationships. It represents the institution-wide commitment that usually has to be made to address the societal concerns of the future. Another such institution is the University of Wisconsin—Green Bay.

The University of Wisconsin (Green Bay)—UW-Green Bay was chartered in 1965 by the state legislature to devise an innovative program directed toward the probable future. At the time of its inception environmental issues held public attention, so the college choose that area as its domain. The academic plan in Green Bay was transdisciplinary in its focus on ecology and man and the environment (see Stafford 1972, p. 20). The college location suited its commitment:

> The campus is located near the mouth of Lake Michigan's Green Bay, in a region rich with farmland, forests, and small cities and abundant with wildlife, waterfowl, and commercially important fish. The region's thriv-

ing paper industry presented an opportunity to examine and deal with water and air pollution, while natural areas, such as the Bay Beach Wildlife Sanctuary, could serve as laboratories for studying ecological systems. (Sheppard 1978, p. 30).

The informing idea of the college is that students should be able to apply what they know to real situations. Students at Green Bay select from nine concentrations, the equivalent of majors for students and departments for faculty: science and environmental change, social change and development, regional analysis, urban studies, human development, humanistic studies, communication and the arts, human biology (including nutritional science, human adaptability, and population dynamics), and managerial systems. These are divided into four theme colleges: environmental science, creative communication, community sciences, and human biology.

Students are not constrained in their choice of course within disciplines since there are few requirements in the four theme colleges. This fall, "in a concession to traditionalists," "all-university requirements" mandate 30 credit hours, 27 of which will be in liberal education and distribution, and 3 credits in a senior seminar. This breaks down into nine hours each in social sciences/natural sciences and humanities, plus the three-credit senior seminars.

Ninety percent of the undergraduates are from the community, and most of them commute. One-third of the undergraduates are part-time and are over 25 years old. Chancellor Weidner notes that "most of the regional students represent first-generation higher education students" (Sheppard 1978, p. 31).

Here the move is to a form of "distribution" control to ensure students have had a taste of the tripartite division that demarcates many institutions of higher learning and illustrates the difficulty of maintaining an experimental environment using faculty who presumably have not themselves gone through the nontraditional experience.

The social-relevance approach of Green Bay is a curricular device that has increasing applicability to the environmental dilemmas facing the world, dilemmas that increasingly need people trained in an interdisciplinary mode.

Griffith University (Brisbane, Australia)—Griffith University was established in 1971 and admitted its first undergraduate students in March 1975. It has no campus dormitories—instead, the University Housing Office helps students find housing in the nearby suburbs. Instead of single-subject departments, Griffith has four schools that

are based on contemporary themes, issues, and problems: Australian Environmental Studies, Humanities, Modern Asian Studies, and Science. The purpose of this problem-centered approach is "not only to teach students to master the intrinsic components and problems of the themes, but also to equip students to see and solve other complex problems of contemporary culture in their professional careers" (Griffith University 1978, p. 4). Griffith University intends to add more schools, some professional, as the university expands.

After three years of study, students are awarded either a bachelor of arts or of science degree. An extra year of study is required for an Honor's degree. The Master of Philosophy and Doctor of Philsophy, as well as Master of Science degree, can also be earned.

Each school has a first-year program that all its students take. For example, in the School of Science first-year studies integrate teaching in basic sciences (physics, chemistry, biochemistry, biology), mathematics, and science, technology and society. Advanced studies can be selected from experimental physics; chemical physics; chemistry; biological chemistry; biochemistry; life sciences; science, technology, and society; and mathematics. Participation in team discussion, critical, evaluative report writing, and self-directed project work are emphasized.

Teachers are called "faculty staff." They prepare and deliver courses, read students' written work, and conduct "problem" classes, tutorials and laboratory classes. Each student has a Personal Tutor who remains with him or her throughout the student's undergraduate career. These tutors may assist students in both academic and nonacademic matters. The University also has a counselling service.

One of the most interesting aspects of Griffith University is the concentration on employment prospects for their graduates. Some of the services offered by the Careers and Employment Service include efforts: to help employers learn about the kinds of graduates the University produces and their skills and qualifications; to provide facilities for employers to meet staff and students of the university, including campus interview programs, seminars for careers, and informal visits; to assist students and graduates in their practical preparation for work, including job applications and interviews; to publicize local, national, and overseas vacancies to final-year students and graduates; to counsel students and graduates on all aspects of career choice; and to provide up-to-date information to staff, students, and graduates on employment opportunities and requirements, by frequent contact with employers and professional groups.

Griffith University sets out to develop students who have the requisite social, intellectual, and technical skills for modern society and to bring this to the attention of prospective employers. The institutional model it provides is timely, unusual, and integrative.

Professional

University of Houston (Clear Lake)—The University of Houston at Clear Lake is an upper-level college that offers bachelor's and master's degrees on an interdisciplinary basis. In a statement dated June 23, 1977, the University reiterated its belief that knowledge cannot be

> departmentalized into isolated disciplines . . . [because] the problems and issues of a modern society overbound the traditional confines of self-contained schools of thought and, therefore, can best be analyzed from an interdisciplinary perspective. (University of Houston, Clear Lake 1977, p. 1).

The university does not have divisions or departments, but is organized into seven program clusters under three deans. The cluster areas are Business and Industry, Humanities, Human Sciences, Professional Studies, Public Affairs, Science, and Technologies. There are 150 full-time and 50 part-time faculty, who serve 4,800 full-time and 5,200 part-time students. Sixty-two percent of these students are at the master's level. Sixty-five percent of the students are in the School of Professional Studies (Rodriguez 1978).

In the Sciences cluster, an effort is made to provide courses of general interest, with very low prerequisites to encourage nonscience students to enroll. Some of the courses are: Modern Astronomy, Biological Clocks, Medical Ethics, Environmental Chemistry, Floods and Subsidence, Introduction to Weather and Climate, History of the Mathematical Sciences, and Pollution Biology.

At the request of the State Board of Control, the technology faculty has helped colleges and universities select and procure computer resources to promote services to a wide variety of disciplines. They have published internationally used textbooks, presented papers at international conferences, designed and developed computer systems that are being marketed internationally, and participated in programs to design, develop, and train personnel to participate in "highly interdisciplinary activities" for the government of Algeria (p. 17).

Faculty activities at the college include: team teaching, teaching in programs other than within the primary assignment, cross-listing

of courses, serving on interdisciplinary program committees, advising students in other disciplines, creating special programs or centers for service and problemsolving, and offering a wide range of courses for nonmajors.

Some recommendations of the report on "Interdisciplinary Activities" are to continue the arrangement of mixing faculty from different disciplines in faculty suites; that new faculty members' vitae be sent to all program directors; and that each faculty fill out a form listing experience and expertise so that program directors can develop "a university-wide faculty data bank" (p. 18).

The unusual dimension of the University of Houston-Clear Lake is the complete interdisciplinary focus of its professional programs and the devices it uses to keep the idea of interdisciplinarity before the eyes of faculty, staff, and students. The societal outcome of its programs is clear, as are the professional benefits when students participate in project teams at their job following graduation.

University of Kentucky (Lexington, Kentucky)—All baccalaureate students in the College of Allied Health Professions must participate in the Kentucky January program, an interdisciplinary exposure believed beneficial to the training of the health professionals. It is designed to give students a problem-oriented instead of a discipline-oriented idea of a "team." Student teams are made up of those disciplines that can best solve the problem, and leadership would change as the problem changed. The team is considered a " 'thought process' whereby any one professional, by increasing his knowledge of the roles and capabilities of other professions, can call upon others more rationally" ("Proceedings . . ." 1975, p. 11). This is accomplished by sending interdisciplinary student teams to sites across the state, with the same task of observing and analyzing their respective communities' health delivery systems.

Meetings are held during the fall semester to insure students begin the program with a common knowledge base and know what is expected of them. During the first meeting, teams are formed and purposes are reviewed, along with the philosophical objectives and logistics of the program. At the second meeting, the students are told what to expect in the field. To aid their understanding, a video-tape of previous students' evaluation is shown. The third and final meeting concentrates on the field models related to the health care environment, the philosophy of the team, and how the field activities relate to the academic field models.

The Kentucky January program is essentially vocational and does

not have a broadly integrative rationale. It does typify the approach many fields have adopted to integrate theory and practice. It is the students who represent the "interdisciplinary" aspect of the program; as described, the team is actually multidisciplinary with the potential for interdisciplinary activity.

Carnegie-Mellon University (Pittsburgh, Pennsylvania)—At Carneigie-Mellon, the premise of the academically selective College of Humanities and Social Sciences is that "the intellectual foundations of a challenging liberal education and the foundations of an excellent professional education are virtually indistinguishable" (Carnegie-Mellon [1977], p. 1). It is also believed that "the basic problem-solving and intellectual skills" needed to be a professional, a citizen in a free society, and a human being are identical. To that end, a core curriculum was developed, along with professional subfields, that were intended to provide "excellent job-specific preparation" for undergraduates. The purpose of this complex of core and major/professional subfields is practical: "Those who elect to pursue graduate training will be well prepared; those who wish to enter the world of work will have demonstrable skills to offer a prospective employer" (Carnegie-Mellon [1977], pp. 5-6).

The core curriculum comprises the first two years of study and gives students "a common base of skills, concepts, perspectives and knowledge" to help them "choose wisely their area of specialization." The unifying idea is "problem-solving," which is understood as "a vital human activity . . . common to all fields of endeavor." Some courses focus on perspectives; others, on techniques and methods.

There are five interdisciplinary clusters of courses, mini-courses, and learning modules, each cluster "representing an important facet of modern liberal-professional education" (p. 2). The clusters are: Fundamental Methods and Skills, which has to do with "the ability to comprehend and use language in its written and spoken forms" and "the ability to comprehend and use mathematical and computational languages;" Humanities and Social Values, which seeks to "confront students with their own values and beliefs" and includes a look at how our cultural value assumptions evolved by looking at cultures remote from the student's own culture; Social, Political, and Economic Systems, which has to do with educating students for a career and citizenship in a free society, and includes a methodological framework supplied by the behavioral sciences and economics to examine social systems; Science and Technology, which requires a student to take a one-year course in either physics, chemistry, biology,

or physiological psychology or two courses in mathematics, or statistics, or computer science; and Language and the Arts, which is called a "distributional" cluster. Here students must learn a second language or examine the arts in a historical context and in relation to the other subjects they have been studying.

After the first two years, students can specialize in one or two major academic or professional subfields, or combine a disciplinary major in one or more professional subfields, or may pursue a five-year program leading to two degrees. The civic ideal is clearly stated by Carnegie-Mellon and the influence of the approach in the College of Humanities and Social Studies is evident. However, the opportunity for integration of subject fields in the five interdisciplinary clusters seems limited. Also, the unifying idea of individual problem-solving receives a very different, much more "academic" emphasis than, for example, at the University of Wisconsin—Green Bay.

University of Florida (Gainesville)—Another institution with a professional basis is the University of Florida at Gainesville. In contrast to Carnegie-Mellon, the last part of the students' undergraduate training is where the interdisciplinary experience occurs. As a result of a National Endowment for the Humanities grant, the University of Florida began a five-year effort to incorporate "the method and substance of the humanities into the education of professional and preprofessional students" in health care (medicine, nursing, and health-related professions), law, engineering, and business administration (University of Florida (Gainesville) 1976, p. [1]). The basic grant of $600,000 from NEH has been augmented by private funds for a projected investment of $2.7 million.

Impetus for the course derived from faculty members at the University of Florida Medical School, who were concerned about the quality of education of first-year medical students from every part of the country. Courses are all senior electives that are team taught. The purpose of the program is to instill professional students with the values and attitudes that only a study of the humanities is thought to provide (Carson 1978, p. 40). The outcomes associated with the humanities are "broader cast of mind," and "habit of contemplation," which are combined with nonhumanities outcomes of "sense of urgency, immediacy, and action" (Carson 1978, p. 41).

The essence of "Humanities Perspectives on the Professions" features multidisciplinary "core courses" structured in relation to issues facing lawyers, businessmen, physicians, engineers, nurses, and other therapists. Topics include abortion; euthanasia; the distribution of

resources between pure research and county clinics; imagination as a creative and descriptive force in human institutions; the law as a paradox of constraint and liberation; the paradox of the engineer who has the ability to build but the interest in the general welfare to redesign; and a perspective on history that yields a view of the natural development of the ethos and concern of the marketplace. Professionals from these areas join with professors of history, literature, and the human social sciences to assess problems confronting professionals. The instructional program is coordinated with a research effort conducted by teams from both the professional schools and the humanities.

"Special topics courses" are spin-offs from core courses and are also team taught, with one or more professional and one or more humanist in each course. It should be emphasized that core courses are intended for advanced students in the preprofessional or professional sequence.

> Instead of taking required general education humanities courses as a freshman . . ., the students are given the option to enter directly from high school into their professional sequence, and put off their humanities courses, until late in their undergraduate career. [It is hoped] that the added maturity in their chosen careers, the added seriousness and motivation, and the position of responsibility, will all work together to help and encourage the students to take their humanities courses seriously, as materials and perspectives for their future careers, as something that matters, as "equipment for living," and not as hurdles (Schemling 1977, [p. 6]).

This program raises the issue of how prescribing humanities studies for students preparing for professional careers can be both timely and integrative. Also raised is the question of the best place for the broadening the humanities are supposed to provide: many other institutions place this component at the beginning of a student's college career to offset early specialization. In schools with a professional or graduate school orientation, the University of Florida, Gainesville approach is common and is believed to achieve the desired result.

American University (Washington, D.C.)—The general goal of the doctorate program in Literary Studies at American University is to train professional humanists for careers of learning (American University n.d., p. 3). The program, begun in 1970, is based on the idea that it is possible and desirable for faculty and students to come together as a "community of learners." The three major emphases of the program are: teaching as integral to learning; mastery of theoretical-methodological concepts; and the development of interdisciplinary habits of thought.

Because of its interdisciplinary thrust, the program is understood as an attempt to redefine the essentials of literary study: "We wish quite deliberately to break the stranglehold that the historical approach has traditionally had on English departments" (American University n.d., p. 2). Some of the activities students participate in are unique to graduate study in any discipline. Each student "reads" under the guidance of a faculty tutor and during each of his three years does one major investigatory work in lieu of a dissertation at the end of the process. Students must also demonstrate "an adequate mastery" of one discipline other than literature and should be able to relate its concepts and methods to the study of literature. Some fields from which the student might select a second concentration include a foreign language and literature, psychology, music, theology, or physics.

In the third and final year, the focus is on a problem that arises out of "the intersection of literary study with the study of another discipline" (American University [1975], p. 6). The third-year student also must devise and teach a course each semester that has an interdisciplinary structure (p. 11).

Here the term *interdisciplinary* is used generically and includes cross-disciplinarity, which corresponds to the program description of experiences the student will have, i.e., selecting a second field and relating it to a primary field. The syncretic nature of the program results not from team teaching, but from the student's own powers to integrate the learning experience afforded. The attempt to redefine the field of literary studies could lead to a paradigm shift that could affect other disciplines as well, especially the "nonliterary" discipline the student chooses. It also will effect the concept of "professional" in the field of literature.

Programmatic

Portland State University (Portland, Oregon)—Portland State considers itself a "downtown" institution with a clientele from homes where liberal education is not prized very highly (see Hart et al., n.d.). They requested an NEH grant to develop courses that would enable students to understand the interrelatedness of western culture, including political and intellectual history, movements in literature, art and architecture, and music. The secondary intent was to develop an alternate way to satisfy distribution requirements, which is a typical reason institutions give to explore the interdisciplinary option.

The idea for such a sequence of courses originated with the University Scholars' Program, a variant of the Honor's College idea, with an enrollment of 200, mostly premedical students. Since most of these students were science majors, and because "medical schools, through admission policies and entrance examinations, have come to demand broad horizons of their candidates," such a program seemed eminently suitable (Hart et al., n.d., p. 2). Like many of the institutions in this sample, Portland State believed it permitted too many of its students to graduate as "skilled technicians" without giving them the opportunity to explore the relationship of their skills to a broader context, where the need for those skills emanates. Nor were they provided many institutional means to explore the other primary areas of human experience beyond their own disciplinary choices.

Portland State's approach was to begin a six-term Science and Humanities course, the major emphasis being to establish "interrelationships." The six terms were: The Ancient World, The Middle Ages, The Renaissance, The Eighteenth Century, the Industrial Age, and the Age of Technology. The first teaching team included an intellectual historian, a literary expert, and specialists in art history and the history of science. The approach they took was both topical and thematic.

The original Science and Humanities course was modified to permit students an option of not being committed for all six courses and to accommodate the science colleagues belief that "something more than the history of science be offered for the nine hours of science credit." The two interdisciplinary courses offered to deal with this complaint in 1977-78 were Human Ecology and Man and the Biosphere. This concern on the part of science faculty undoubtedly stems from the belief that unless scientific method and laboratory work are included in such endeavors, students are not getting the necessary scientific training to proceed with a science major. Also, some science teachers believe a history of science course is more suitable for upper-level science majors than freshmen or sophomores.

The exemplary aspect of this program is the attempt to bridge the gap between science and nonscience fields by studying historical eras and concentrating on ideational interrelations. The civic ideal is served by Portland State's concern to not merely graduate "technicians" but students who can define the world in ways other than by the givens of their discipline.

University of Southern California (Los Angeles)—The "Thematic Option" idea was begun at USC in the fall of 1975 as an attempt to

meet general education requirements at the freshman level. Because USC is a metropolitan "commuter" campus, the University Goals and Priorities Committee recommended that a sense of "community" be built into its academic programs. The committee also recommended the development of closer curricular cooperation between the College and its professional schools, and suggested that the future of general education "lay in the nurturing of alternative options, developed in terms of differing integrative principles." The National Endowment for the Humanities awarded USC a planning grant for 1972-1973, followed by a curriculum development grant in 1974.

Four interdisciplinary, team-taught "core" courses—the heart of the Thematic Option idea—were offered in 1975-1976 (University of Southern California 1976). They were: "Symbols, Verbal and Non-Verbal," which had a methodological, epistemological thrust; "Quality of Life, Values and Life Styles," which was intended to raise ethical issues; "Environmental Quality," which focused on the process of change and hoped to develop skills in quantitative methodology and in relating quantitative measurements to value identification; and "Change and the Future," which had an ethical component, including a focus on the responsibilities of citizenship. Thus, most of the educational ideals described previously in this monograph were included in the core.

In 1976-1977, the course on "Environmental Quality" was replaced by "The Process of Change in Science." This change was made for a number of practical reasons, not the least of which was that for all science undergraduates, the four core courses constituted their entire general education; it was thought that a coherent, "humanized" curriculum should emphasize ethical ("Quality of Life" and "Change and the Future") and methodological/epistemological ("Symbols and Structures" and "The Process of Change in Science) issues.

The "Process of Change in Science" core course attempted to give students a somewhat more sophisticated concept of natural science than they would get in the "standard" curriculum. To that end, students read and discussed two of the more influential contemporary philosophers of science, Thomas Kuhn and Karl Popper, and concentrated especially on their theories of the nature of science and of scientific change. The pedagogical approach bears on the question of whether such courses provide enough practical experience for students expecting to major in science:

> Some sections [are] taught by guest lecturers, most of them important innovators in their own fields. Each guest lecturer will discuss a critical

period in the development of a scientific specialty—physics, mathematics, biology, and astronomy—and in the process will teach a modicum of scientific subject matter, enough at least to render the students scientifically literate.

The course will conclude by looking back to the first section and discussing the ideas of Kuhn and Popper in the light of what scientists actually do (USC . . . Spring 1977, II-1).

"Theme" courses are extensions of the four core courses. They are open to any student in the university, whereas the core courses pertain only to freshmen. Of 40 proposals for new courses originating in the Humanities, 17 were approved by the Steering Committee. Seven of the new theme courses have been offered to date. They are: English 481, Life Histories: Reading and Writing an Autobiography; Business/Religion 461, Business and Society; English 281, Sensibility and Success; Religion 250, Political Symbols in Western Art; and Religion 319, Myths and Symbols of Death and Dying. Some of the courses will become part of the regular departmental offerings for majors in various fields as well as being available for nonmajors as general education courses.

Four interdisciplinary colloquiums on American themes were held for the purpose of faculty development during the first two years of the Thematic Option (University of California 1976, pp. 15-16). They were meant to be occasions when all members of the USC faculty could interact around themes related to the Option. The topics were: Aging: Myths, Rituals, and Values; The Symbolism of Aging—The Symbolic Construction of Lives; The American Family: Its Changing Images and Social Implications; and Corporate Responsibility and Control. A fifth colloquium called Literature and the Other Arts took place in 1977-78.

A further significant outgrowth of this program is the holding of smaller scale colloquiums to serve a more special purpose. Based on a syllabus prepared by the Core Committee on "Change and the Future," a two-day meeting was held that included participants from the three major divisions of the college. Its focus was "The Problem of Perception: Reality for the Humanist, the Social Scientist, and the Natural Scientist."

In many instances, materials developed for theme courses are used in courses for majors in the various departments, including graduate courses. The Steering Committee observed that two "clusters" of interdisciplinary courses were emerging: One on literature, art, and film; and the other on social ethics in relation to career and professions, especially law, medicine, and business. As a consequence,

the possibility of developing a certificate program in each area is being investigated.

Optional activities, in addition to courses, are special evening seminars, film festivals, theater groups, and retreats. English composition is not taught as a separate course, but rather is an integral part of the thematic interdisciplinary courses. The Core courses were developed by eleven humanities faculty, who were released from teaching one course or were given research assistants to serve as team members to develop these courses. Sixteen faculty have been released to develop theme courses.

The courses are typified by low student-faculty ratios and are taught by some of the best faculty. It is believed that a permanent core faculty should not be recruited by the program; instead, there should be continual "infusion" of new faculty, which then would grow and develop into a "community of instructors" who share the values and skills embodied in the Thematic Option. This seems to be a fruitful approach. In the most recent progress report of January 31, 1978, it is stated that the Thematic Option is becoming "a valued arena for the nurturing of interdisciplinary skills" among faculty (University of Southern California 1978, p. 4).

In retrospect, the 1978 report suggests that in the past, USC had difficulty recruiting and retaining highly motivated liberal arts students (p. 2). The Thematic Option appears to have remedied that condition. The program is committed to remaining relatively small (about 90 new students enter each year); it is believed that smallness is the price one pays to ensure long-term stability. It is also noted in the report that in the history of other experimental programs across the country, about half of the innovative courses will survive.

The interdisciplinary program at USC does not have a civic ideal outcome but does stress the integrative practice of true interdisciplinary work. The program would help academically adept lower-division students broaden their educational sights before selecting a discipline.

University of Santa Clara (Santa Clara, California)—Santa Clara University is the oldest higher education institution in California. In 1977, it had a total student population of 7,295, which is divided almost evenly between graduates and undergraduates. Of this population, 1,800 are undergraduates who live on campus. A large number of students are transfers from California community colleges; of the undergraduates in the College of Humanities, one-third do not start a four-year program at Santa Clara.

To combat the tendency of undergraduates to specialize too soon, Santa Clara has as its chief goal to provide an integrative educational experience for its students. Its stated mission is "to provide a broad education for the whole person" (Rewak 1978, p. 11). To that end, three colleges—the College of Sciences, the College of Humanities, and the School of Engineering—offer interdisciplinary degree programs for undergraduates.

The College of Sciences awards a B.C.S. (Bachelor of Combined Sciences) degree. In their first three years, students take required courses in chemistry, mathematics, statistics, physics, biology, economics, psychology, sociology, anthropology, and political science. During the fourth year the student has greater choice over academic options.

The core curriculum in the College of Humanities is a result of the deliberations in spring 1975 of a committee of faculty and students. The program began in the fall of 1976. Its goal centers on the basic characteristics of the educated man or woman as articulated by Dean Rosovsky of Harvard. They are:

> (1) an ability to think and write clearly; (2) an informed acquaintance with the mathematical and experimental methods of the physical and biological sciences; (3) an awareness of other cultures and other times; (4) some understanding of, and experience in thinking about, moral and ethical problems; (5) good manners and high aesthetic and moral standards; (6) depth in some fields of knowledge.

The essence of the core is eight units of English, eight units of science; twelve units or equivalent of a foreign language; four units of social science; four units of philosophy; four units in a creative or performing art; and twelve units outside the major, which must be earned in one of seven interdisciplinary (humanities) sequences—African Civilization, Asian Civilization, History of Western Art, History of Philosophy, Latin-American Civilization, Literature of the Western World, and Western Civilization.

The real "core" of the lower-division is the interdisciplinary sequence, which stresses "the unity of the humanities" and provides the student with a series of three courses that have as their object the study of the growth and development of a culture as portrayed in its art, history, literature, and philosophy. The belief is that this sequence will lead to an "integrated" curriculum and will give a foundation for a "truly liberal education." This is considered an imperative to achieve the overall goal of the University, since it gives students, especially the large transfer population, a common

frame of reference on which to base subsequent studies.

The School of Engineering offers a major called the "da Vinci Program," so named because Leonardo da Vinci personifies its interdisciplinary goals. It provides students with the fundamentals of engineering, mathematics, the physical and social sciences, and the humanities, with a limited amount of specialization in a major field. The program was begun in 1973 and graduates about five students a year out of a class of approximately sixty.

According to Robert J. Parden (1978), Dean of the School of Engineering, students who enter this program out of high school, unless they are strongly motivated, often choose to major in engineering per se rather than continue in the da Vinci Program. Many of the students who persevere have a nonengineering career goal in mind after graduation; for example, a medical degree, or a M.B.A. program, or a nontraditional or multidisciplinary graduate field like environmental studies or oceanography.

Santa Clara also offers interdisciplinary institutes where students can specialize in one particular subject for a quarter. The College of Science established an Institute on Aging that will continue in future years and is expected to become an important center for interdisciplinary teaching and research on aging.

Santa Clara links the "aristocratic" emphasis on the development of the whole person to the students' responsibility beyond the university experience:

> It is believed that as a forum for intellectual exploration, the University must constantly investigate and question the principles of our social, political, and economic structures. It must force society to confront itself (Rewak 1978, p. 13).

This is a very clear expression of the civic ideal outcome. Interestingly, courses are usually not team taught, and the student is expected to forge the connections across disciplinary lines. Faculty do convene as a group to develop courses, use is made of guest lecturers from many departments, and faculty meet regularly to discuss what they are doing in their courses. According to definitions provided earlier, the approach at Santa Clara could be interpreted as multidisciplinary rather than interdisciplinary. There is also a rigidity about the curricular approach that is somewhat atypical of interdisciplinary programs. This may be due to the need to ensure that certain disciplines are not given short shrift, especially since three different colleges offer and must be accountable for degree programs using the "interdisciplinary" idea.

The University of Minnesota (Minneapolis)—In the fall of 1971, a Core Committee of the Panel on Education in the Liberal Arts proposed a School of Cross-Disciplinary Studies at the University of Minnesota ("New Directions . . ." 1971). The committee reflected the higher education goals for the Minnesota state system as expressed in the report *Toward 1985 and Belond* (see "New Directions . . ." 1971, p. 70). To reach the goal of "improving the quality of life," the report urged the development of the problem-oriented interdisciplinary programs of teaching and research as well as greater decentralization of University program organization (New Directions . . ." 1971, p. 70). In response, the committee designed a three-stage model for the bachelor's degree curriculum:

> (1) Several Lower Division articulated, coordinated programs of introductory courses satisfying distribution requirements, among which the student could choose. (2) A third year devoted primarily to work in the student's field of concentration. (3) A senior year to consist of further studies in the major and of interdisciplinary integrative courses and programs (p. 71).

It was specified that the introductory courses were for the purpose of general education and not as preparation for "presumptive specialists." But the committee held that interdisciplinary work should culminate in, not begin, a college education. It maintained that gaining special knowledge and experience in diverse areas and the ability to group interrelations and to perceive general applications requires that students be comfortable with the pertinent disciplinary concepts and techniques of analysis or expression. All this learning must be accomplished before fruitful interdisciplinary work can be undertaken (p. 68).

To reach this stage, freshmen and instructors meet to discuss points of course "intersection and interaction." Courses retain their disciplinary emphasis but are constituted to relate to other courses students take. As was intended, faculty teach what they know best, while being given the opportunity to engage in stimulating interaction with colleagues from other fields. An expected byproduct of this collegiality is the development of new interdisciplinary courses.

During the sophomore year, when students take their science requirement electives, students can begin their prevocational concentrations and participate in interdisciplinary courses. An ideal outcome of this stage would be that increasing numbers of science instructors might become involved with an interdisciplinary team and begin to coordinate their courses or programs.

The third year is devoted to the student's major concentration. In the senior year, after gaining "a background in several disciplines and in an area of concentration," the student takes one or more interdisciplinary courses each quarter. These are related to the student's "moderately firm, disciplinary base" and are problem-centered, though the disciplines remain separate. Example of such problem-centered, interdisciplinary work are: for the social sciences, developing countries; for the humanities, the nature of language, its structure, social context, development, and relation to the problem of meaning; for the sciences, a year-long course is possible in the history, sociology, and philosophy of science. Of importance is the original recommendation for the interdisciplinary science course

> [Avoid] technical minutiae and strive to put the scientific enterprise in perspective as a human and social activity. It should provide a sense for the place of science in history and society, its interaction with other social forces, its intellectual context, its moral implications" (p. 76).

Three types of "interdisciplinary" approaches were developed: cross-disciplinary studies in special sequences, experimental courses, and interdepartmental programs. In 1974-75, the special sequences for freshmen were Varieties of American Experience, Health Science, and Studies in Arts, Language, and Mind; the junior-senior sequences consisted of coordinated groupings of courses and symposiums where issues are discussed to join courses together.

Examples of interdisciplinary sequences for freshmen and sophomores are "Law and American Society," "Symbol Systems," and "Arts and Mind." The sequences are to provide "a coherent academic program by coordinating introductory courses in several fields," and to "establish small communities of learners within the larger university setting." To encourage this community of learners, a Commons Room is provided where students can congregate between classes for discussion, relaxation, or study. The academic advisor and teaching assistants keep hours in this room so they may be accessible to students.

Experimental courses came into being at the suggestion of faculty; these courses satisfy the requirements of the College of Liberal Arts Curriculum Committee on Experimental Courses. The experimental courses are offered under a departmental name or under one of three interdisciplinary titles: social science, language and fine arts, and natural science. One such course, "Ecology, Technology, and Society," has become a "regular" offering administered by the mechani-

cal engineering department. Its purpose is to give an integrated perspective on the interaction between man, technology, and society.

The interdepartmental programs are Women's Studies and East Asian Studies. An individually designed, interdepartmental major program also exists whereby students develop their own program emphasis. If a student decides to pursue an interdepartmental, interdisciplinary major, then during the sophomore year or early in the junior year, a comprehensive statement of academic goals, including long-range projections, must be developed along with a short title for the program. In the student's senior year, a project is required. Some examples are: an internship with a business or social service agency, summarized and evaluated in a paper; an original research project; a review of the literature concerning some aspect of a student's major field; and an original work or other demonstration of relevant artistic development. At least three disciplines must be called upon. Out of 17,000 students, only 100 elected this option, of which one-half were honor students (Eaton 1978).

If the School of Cross-Disciplinary Studies is to achieve its potential, then departments and their faculty will have to take a broader view of their teaching responsibilities. It is stressed that the mission of departments will have to include a commitment to cross-disciplinary studies (see Chambers 1971). To encourage this, the Committee recommends that instructors among the core teaching faculty should serve two years in the School, with four or five being optional. It is believed this schedule would provide faculty the time to develop and polish courses and allow instructors to participate in the experience of a core student group from the freshman through senior year ("New Directions . . ." 1971, p. 77).

A final recommendation is a proposal for a Graduate Center for Advanced Interdisciplinary Research. It would be problem-oriented and based in the humanities and social sciences. This center, ideally, would participate in undergraduate activities, so that research interaction would take place at all levels of instruction (p. 79).

The University of Minnesota has many options for interdisciplinary work, from individual courses to individualized interdisciplinary majors. The general purpose of these activities is to broaden the horizon of students who will ultimately specialize. Senior-level interdisciplinary activities are compartmentalized according to humanities and sciences, with no apparent provision for overlapping interests. The scribe ideal is ultimately served by this particular approach.

Because of the variety of curricular possibilities under the rubric of "cross-disciplinarity," all outcome categories could apply.

Summary of Program Development

In this section, we have seen that some institutions have accommodated the interdisciplinary format by throwing over the existing disciplinary structure and replacing it with an interdisciplinary structure. This result suggests that those institutions concluded that had disciplinary interests prevailed, there would have been impediments to true interdisciplinary programs. Other institutions have made interdisciplinary options available in the form of major programs or departments that exist in tandem with disciplinary modes, the disciplines being drawn on for support in the form of faculty release time and program sanctions. The welter of interdisciplinary activity and the self-confident tone emanating from program descriptions mask the multifarious aims of interdisciplinary programs, which structures often reflect compromises forced by faculty who find it difficult, if not impossible, to think in categories that are not discipline bound. To minimize the effect of such pressures and advance the probable success of interdisciplinary programs, institutions either establishing or evaluating these programs would do well to consider adopting a similar type of educational-outcome model typology suggested by Bouwsma, as well as the ordering of interdisciplinary program types suggested by Boisoit.

Conclusions

There are many inconsistencies besetting interdisciplinary endeavors: definition of the term itself has proven elusive, if not in theory then in practice; there is no convenient interdisciplinary frame of reference for faculty working within an established discipline; there is no preset subject matter, no established teaching methods, and no unique analytical tools for interdisciplinary study (see Potter 1977, p. 7). Also, the types of students participating in interdisciplinary activities vary greatly: some programs seek out or only appeal to the best student; other programs are nonselective, in the belief that the interdisciplinary mode is suited to all types of students. Then there is the question of when interdisciplinary work should be undertaken: at the lower-division or the upper-division, or throughout the student's undergraduate and graduate career?

Expansion of interdisciplinary activity continues unabated, due in large measure to federal funding and the desire of individual institutions to change or improve their general education matrix (interdisciplinary activity is often put in place to solve or supplement general education requirements). The usefulness of interdisciplinarity to address social problems seems clear. The basic tension between dynamic social forces in America and absolute notions of academic domain are propelling curricular change in the direction of interdisciplinarity. Many see such a development as long overdue: Stephen Bailey believes that America's scholastic and collegiate curriculum needs to be reexamined "to see where and how syndetic exercises can be insinuated into existing materials, how new knowledge can be introduced that forces students increasingly to reckon with complex interdependencies" (Bailey 1977, p. 38).

Interdisciplinarity as Change Agent

Interdisciplinary programs have the potential for generating both internal (curricular) and external (societal) change. Briggs and Michaud (OECD 1972) point out that the interdisciplinary mode requires educational materials other than textbooks and course notes, thus necessitating the design of "experimental kits of materials" prepared by interdisciplinary teams to satisfy particular learning needs (p. 225). The emphasis is on "progressive discovery" for students and faculty; in Asa Briggs and Paul Michaud's view, this could

act to break the pattern suggested by Thomas Kuhn in 1962, in *The Structure of Scientific Revolutions* (1970), of paradigm shifts occurring through conflict rather than through an orderly process within the sciences (broadly defined) (OECD 1972, p. 225).

To result in social change, Rolf Schulmeister (in Society for Research . . . 1975, p. 54) believes interdisciplinarity should be treated as a practical problem and not merely as a theoretical concept. He points out that discussions of interdisciplinary activities often lead to people perceiving them in a static, institutionalized way. The old academic model of administered change, ordered innovation, and fixed and detailed programs is viewed as the present norm for interdisciplinarity. He believes the existing interdisciplinary paradigm of "innovation"—calling on experts, planning change from above, and in an orderly fashion—should be done away with, and recommends reliance on "the explosive power of urgent social problems and of those people deprived by society." This approach, he thinks, would confront students, teachers, researchers, and educators with the problem and the groups with which such efforts should be concerned (Schulmeister in Society for Research . . . 1975, p. 55). Interdisciplinary activities would take the form of "action research," so that epistemological discussion arises out of action taken rather than from discussion of interdisciplinarity as a theoretical notion. Consequently, the evaluation of interdisciplinary systems "cannot follow the paradigm of empiricist research" (p. 56).* In Schulmeister's view, evaluation is not the primary aim of interdisciplinary project groups because "situations, strategies and instruments of research have to grant sufficient freedom for the activities of the project group."

Earl McGrath (1978) agrees with the thrust of Schulmeister's assessment: "The way to begin creating [an interdisciplinary] course is to identify the major social, personal, and civic problems of the day" (p. 9). He sees the dual engines of American higher education, at least for the student, as being the desire

> to take courses and programs that will assure them of jobs, but they also want educational institutions to help their generation deal with crime, pollution, political corruption, unemployment, inflation, and a host of other equally pressing matters of social policy (McGrath 1978, p. 8).

Briggs and Michaud (1972) suggest there is latitude within undergraduate courses for introducing more project work, especially during

* In 1976, Wain Saeger complained that the majority of evaluation reports on interdisciplinary courses were "unsystematic" and "subjective," often consisting solely of opinionated personal impressions" (p. 12).

the upper-division years "when there is less sharp division between undergraduate studies and post-graduate research work than has become conventional" (p. 225). This assessment is supported by the Carnegie Commission observation that interdisciplinary programs are so well suited to the needs of general education at the upper-division levels that whatever effort is required to implement such programs is worth the energy expended (1977, p. 179). However, the danger exists that unless the interdisciplinary component is present fairly early in the curriculum, later efforts to incorporate it may prove disappointing. One institution abandoned senior-level interdisciplinary seminars because "the seniors were too specialized for interdisciplinary work" (Rudolph 1977, p. 248).

Departmental Prerogatives

Interdisciplinary activity does confront specialists with the inadequacy of their individual disciplines to solve many of the problems plaguing the modern world. The Carnegie Commission believes that if the interdisciplinary approach is to flourish:

> Colleges and universities [will] have to organize their faculties on some bureaucratic principle other than the department or greatly reduce faculty control over the curriculum or persuade graduate schools of arts and sciences to relax their indirect but inhibiting influence on efforts to reform the undergradute course of study (Rudolph, 1977, p. 250).

Even those who see the danger of the present disciplinary system are concerned about whether anything should entirely replace it. For Halliburton, academic departmentalization is a not "inconsequential" structure and he would not necessarily want to see it supplanted; but he views it as "a vast landscape of vested interest reflecting past curricular decisions and tending to prohibit, just by the fact that [departments] are already there, any really significant alterations" (in Quehl, ed. 1977, p. 48). Potter agrees that it is not the desire of proponents of interdisciplinarity "to demolish all departments in all universities, nor is it to deny the values of specialized research and scholarship; interdisciplinarity is not to be advanced as the successor to disciplinarity" (p. 15). However, interdisciplinary program building requires much time and energy that must be shunted from disciplinary activities. The reward system in most colleges and universities is tied clearly into disciplinary pursuits, not those of an interdisciplinary nature.

> Developing interdisciplinary majors may require faculty members to devote enormous amounts of time to student consultations and research in

unfamiliar fields. In fear of "burning out" in such activities, many faculty members prefer to teach within more traditional, departmentally defined majors (Carnegie Foundation 1977, p. 197).

Serious curricular improvement will not occur unless provision is made for educational endeavors that do not fit neatly into disciplinary categories or into a department in which those endeavors normally are included (Halliburton in Quehl, ed. 1977, pp. 55-56). The Carnegie Foundation for the Advancement of Teaching (1977, pp. 285-286) provides some ideas for institutions that are thinking about initiating interdisciplinary courses or programs and are uncertain where to begin:

- More use might be made of interdisciplinary, problem-based studies, such as environmental studies, conservation of energy, and urban studies in organizing the faculty and the curriculum. Such approaches emphasize the unity of knowledge and the cooperative contributions of individual-disciplines in problem solving.

- Colleges might offer all students an opportunity to study the commonality and differences in world cultures. This is the theme on which Friends World College is based. Other colleges might introduce it as a topic either for broad learning experiences or as a component of general education.

- Large colleges or universities with more than 2,500 students might be subdivided into thematic college units. Small college units can enrich the learning environment and give students a chance to work closely with faculty members and fellow students.

- Several institution-wide nondisciplinary faculty positions might be created. This would permit colleges to appoint faculty members who do not fit comfortably into any single discipline and ensure the existence of at least a few interdisciplinary courses on campus.

Recommendations

Given the striking diversity that characterizes interdisciplinary programs, some guidelines would seem mandatory, especially when dealing with curriculum design. It is in this context that the following recommendations are offered:

- Expected educational outcomes should be clearly articulated. The means to achieve these outcomes must be carefully considered and a matrix of program characteristics developed as a point of reference for evaluation.

- There must be institution-wide support for interdisciplinary programs. Without it, programs will be unnecessarily isolated from the primary academic activity of the college or university. Interdisciplinary programs should be an integral part of an institution's

educational mission if they are to function well. This means they must be supported by the institution's president and his or her administrative officers as well as deans and faculty.

- The disciplinary reward system must acknowledge, sanction, and encourage interdisciplinary activity in teaching and research. Without adequate reward or incentive, faculty will shy away from such activity, which will cause staffing problems that could paralyze a program or cause the program to be defined by the knowledge of those faculty willing to participate.

- The relationship of the sciences to the humanities should be a central issue for interdisciplinary curriculum designers. The possibility of interdisciplinary contexts providing the catalyst for more encompassing curriculum paradigms is very real and could be brought about by discussions of the connections between the two.

- Interdisciplinary faculty must be trained to ensure program continuity and to provide role models for students. The lesson students now learn from faculty is that we are only able to understand by dividing the world into parts. The ramifications of this fragmentation is that our models for developing synthetic management approaches to national and local problems are very limited (see Kash 1976, p. 157). This view suggests that integrative curriculum models should be staffed and guided by faculty and administrators who themselves believe in the fruitfulness of the integrative approach for society, their students, and themselves.

It is possible that interdisciplinary programs represent the best place to forge a new disciplinary architecture, an arrangement of parts that does not merely reveal a deeper symmetry or set of correspondences among seemingly disparate realms of experience and intuition, but also could lead to major shifts in our understanding of ourselves and the questions we ask of our universe. Finally, as succinctly stated by the Southern Regional Education Board:

> Whatever future returns the public may gain from higher education —indeed, the essential value of higher education—seem to lie in the synthesis of research, service, and trained manpower toward full human development and consequently toward the improved quality of life in this society. The interdisciplinary approach will most certainly be one of the more vital and valid instruments education can employ toward that end (SREB 1976, n.p.n.).

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